The University of Chicago

AN EXPERIMENTAL STUDY OF THE READING OF SHORTHAND

A DISSERTATION SUBMITTED TO THE FACULTY OF THE DIVISION OF THE SOCIAL SCIENCES IN CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATION

1934

By

GEORGE CARL PHIPPS

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ACKNOWLEDGMENTS

The writer wishes to express his sincere appreciation of the cooperative services of several persons who have made this study possible. He is deeply grateful to Mr. Hiram B. Loomis, Principal of Hyde Park High School, who kindly permitted his students to be used as subjects and warmly encouraged his shorthand teachers to give every needed assistance. Both his teachers and students gave generously of their time and effort in advancing the study and to them the writer's hearty thanks are due. He is especially grateful to Miss Josephine Casavaw who rendered very valuable service as liaison worker between the other teachers, their students, and the experimenter.

In the same spirit of splendid cooperation Mr. Daniel O'Hearn, Miss Joanna Zander, and the shorthand teachers of Englewood Evening School provided the students and room which were used in another part of the experiment. To these officials, teachers, and their students the writer here acknowledges a debt of gratitude. He desires also to thank Mr. B. J. Knauss, Director of Commercial Education in Chicago Public Schools, Mr. F. E. Sanford, editor, Lyons and Carnahan Publishing Company, and Mr. Paul Moser, Director Moser Business College, who have obligingly assisted in writing and criticizing some of the shorthand selections and in securing certain materials and devices used in the study.

Furthermore, the writer feels profoundly grateful to those members of the Department of Education of the University of Chicago who, through kindly interest and wise and stimulating counsel, have guided him throughout the investigation. To Professor G. T. Buswell under whose inspiring leadership the study was initiated and carried on, and to Professor F. N. Freeman who gave valuable critical advice and encouragement, the writer's sincere thanks are here expressed.

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CHAPTER I

NATURE AND PURPOSE OF THE INVESTIGATION

Introduction

The fact that reading is a complex mental process is well recognized by psychologists and students of education. The importance of this process as a fundamental means of learning keeps it constantly under investigation. Within the last two decades intensive studies have been made in phonics and word analysis, word perception and recognition, sentence and paragraph comprehension, and various mechanical aspects of reading. During the same time investigations have been conducted in methods of teaching reading, the content and organization of reading material, the objectives of reading instruction, the legibility of different types of print, the physical make-up of books, the hygiene of reading and the uses made of reading by children and adults.

Practically all of these investigations have dealt with one or more phases of the reading of printed English discourse. A very small number of them, however, have been concerned with the reading of a few other forms of expression, such as music notation (12)[1] and Chinese and Japanese languages (11, 16).

The present study represents an attempt to analyze the process of reading a highly symbolic form of expression, namely shorthand writing. The reading and writing of characters, alone and in sequence, constitute the major activities in learning shorthand. A well-known teacher of this subject has pointed out that

---

[1]The numbers in parentheses indicate title numbers in the bibliography.

> . . . . shorthand is, first, a language arts subject, and second, a practice type subject, and that it should be taught, first, according to the teaching principles of the language arts type, and second, according to the teaching principles of the practice type. This means that the learner should acquire the reading adaptation, then writing adaptation, then exactness, preciseness, and probably a higher degree of skill (2).

Related Investigations

Several studies relating to the writing phase of this subject have been made. These deal mainly with the development of scales and methods to be used in measuring the speed and quality of shorthand writing. Unfortunately, the reading of shorthand has undergone very little investigation. The construction of a scale for measuring the ability to read Gregg shorthand was reported by Hoke in 1922 as a part of his doctor's investigation (10). This scale was not diagnostic, however, and the results obtained from its use threw little light on the nature of the reading process.

More recently an effort had been made by Smallwood-Soutter to determine the kinds and frequency of the errors which 150 beginning students made in reading shorthand (18). Four sets of tests were used, each set having two forms. In the first form of the tests the students read silently a short paragraph in Gregg shorthand and then answered in longhand five questions on the content of the passage. In the second form the students were required to read and then transcribe the contents of the test paragraphs. The investigator identified and described the reading errors revealed by each form of the test. She had difficulty, however, in determining whether some of the errors made under the second form of the tests were reading or transcription errors. In general, the results from this study are limited in scope and application. They are suggestive, however, of a pronounced need for more intensive investigations in this field.

Problems in Present Study

With the exception of the two reports previously noted, the writer found no other records of attempts to investigate the process of reading shorthand, although the need for such investigations has been emphasized by research workers and students in commercial education. The present study was undertaken both in response to this need and as an outgrowth of the writer's interest in the psychological aspects of this type of reading. The study includes four major problems which may be stated as follows.

First, What is the specific nature and the extent of the errors which students make in reading shorthand orally?

Second, What are the main requirements of the process of reading shorthand as revealed by an analysis of the errors made in oral reading?

Third, What are the most important characteristics of the process of reading shorthand as indicated by the eye movements made in such reading?

Fourth, What is the nature and degree of growth in reading ability which students experience in two three-months periods of shorthand study?

The solution of these problems constitutes the primary purposes of the investigation. Other problems which are variously related to the major problems have also been studied. The most important of these are stated below.

First, In what essential respects does the reading of shorthand differ from the reading of printed material?

Second, Are there any important differences in the manner in which different types of characters are read? Do they present different degrees of difficulty in reading?

Third, In what respects, if any, does the reading of students who are being trained by the indirect method of shorthand study differ from the reading of those employing the direct method?

CHAPTER II

PLAN OF THE INVESTIGATION

Preview of Experiment

Seventy-nine high school students and six proficient stenographers served as subjects in this study. The problems were investigated by an experimental method which embraced the following procedure.

1. Four groups of evening-school students read three or four selections of shorthand writing and a printed selection before the dictaphone. The errors which they made were determined by comparing the dictaphone reproductions of their reading with the contents of the selections. These errors were classified and carefully analyzed. The analysis revealed the nature of the errors and the most important causes underlying them. The facts thus obtained serve as specific evidence of certain mental processes which the readers used.
2. Four other groups of high school students and the six stenographers read silently before the eye-movement camera the same selections of shorthand and printed material which were used in the dictaphone reading. All of the data represented by the photographic records of the eye-movements made in reading were tabulated and carefully studied. The records from 118 of the student readings and the records from all readings of the stenographers were plotted. The tabulated data show the numbers, kinds, and duration of the eye fixations and the plotted records show also the order in

which the fixations were made. These data and records provide important evidence of the manner in which the shorthand characters were recognized and interpreted.

3. Both the oral and silent readers represented three different levels of attainment in shorthand study, namely beginning, intermediate, and advanced levels. Comparisons have been made of the group records obtained from the subjects in these various levels of training. Further comparisons between the records of the student groups which read silently and the expert readers were drawn. The results of these comparisons form the basis of conclusions respecting the reading done by the different groups of students.
4. The data and photographic records from the reading of two groups of beginning students, one of which was learning shorthand by the indirect method and the other by the direct method, were compared in order to determine whether any important differences exist in the reading of the two groups.
5. Explanation of certain phenomena appearing in the reading, such as the tendency in oral reading to omit, reread, or misread certain characters and the peculiar nature of the eye movements made in the silent reading of these and other characters has been sought in a comparison of the records of the oral and silent reading of these characters.

The Subjects

Oral readers.- Thirty students enrolled in shorthand classes in Englewood Evening School were the oral readers. Seventeen of these students had nearly finished their first semester's work in shorthand; hence they are termed beginners in this subject.

Ten of these students, constituting Group 1 of beginners, had used throughout their study only shorthand material which was written with vowel markings. Such material is termed "vocalized" as the markings aid the reader in sensing and enunciating the sounds of the syllables and words denoted by the shorthand. The other seven students constitute, for the purpose of the experiment, Group 2 of beginners. Four of these students had used the vowel markings in their reading and writing while the other three had used only the unvocalized type of material.

Six of the other students had reached the intermediate level of shorthand training as they had completed roughly two semesters of shorthand study. The remaining seven subjects had completed three semesters of shorthand training and hence may be regarded as advanced students in this subject. Both the intermediate students which are designated as Group 3, and the advanced students, or Group 4, were able to read and write shorthand in either vocalized or unvocalized form.

Silent readers.- Forty-nine shorthand students of Hyde Park High School and six competent stenographers were the silent readers. At the beginning of the experiment, 20 of the students had studied shorthand for about three months. Eleven of these beginning students represent Group A and the others are designated as Group B. Before and during the experiment these groups used different kinds of study materials and were taught by different methods of instruction. Group A used only vocalized shorthand material and employed the "indirect" or more commonly used method of learning. Group B used only unvocalized material and followed the "direct" method in their study.

Group C consisted of 16 students who had had about 18 months of shorthand training. Group D was composed of 13 students who had studied shorthand for approximately 13 months. The members

of these groups had been trained by a combination of the direct and indirect methods. During the experiment they continued to use the combined method. Accordingly these groups studied a variety of materials appropriate to this mode of instruction and suitable to their respective levels of training.

Group E consisted of six young women who were well trained in shorthand. They were skilled in using shorthand in both vocalized and unvocalized form. In general they proved to be well prepared to serve as expert readers in the study.

The Reading Material

The reading material consists of 13 selections of shorthand writing and one selection of easy discourse in printed form. On the basis of their relative difficulty levels the shorthand selections are divided into four groups which are designated as Groups I, II, III, and IV. Each of the first three groups contains three selections while Group IV consists of four selections. All of the selections within a given group are similar in construction and roughly equal in difficulty.

The selections are designated by their group numbers and the small letters a, b, c, and d. Thus the selections of Group I are designated as Selections Ia, Ib, and Ic. Groups I,II,III and IV of selections were read orally by the students of Groups 1, 2, 3, and 4 respectively. The same groups of selections were read silently by the students of Groups A, B, C, and D respectively.

Four members of Group E read all of the shorthand selections silently. The other two members of this group read before the camera nine selections silently and the other four orally. Because of the numerous head movements and the very great numbers of fixations made in the oral reading, the records from this reading could not be used. The printed passage, Selection V, was read orally by all of the evening-school students and silently, before the camera,

by all the day-school students and the stenographers.

The material used in the selections was prepared in the following manner. The words, phrases, and other expressions composing the various paragraphs were chosen from the body of words, phrases and similar material which the students had already studied thoroughly in their textbooks and manuals. The contents for all selections in a given group were drawn from the same section of the study materials in order that the vocabulary difficulty of the selections might have the greatest equality possible. Likewise uniformity in the length and construction of sentences was maintained throughout the selections of a group. In length the selections vary slightly, the last selection of a group being generally one or two lines longer than the first selection.

Each shorthand selection consists of one or two meaningful and fairly coherent paragraphs. Due to a limitation in the variety of words and phrases which might be used in constructing the paragraphs, the thought transitions in a few instances are somewhat abrupt. However, the hindrance to reading which these weak transitions afford is evidently far less than that which would have resulted had a series of wholly unrelated sentences been used. In fact, it appears that such difficulties as the readers experienced on these transitions were not serious. It was the conviction of the writer, in preparing the selections, that even reasonably coherent paragraphs would more readily facilitate active and meaningful reading than would any other arrangement of the material. Also it seemed that a test of the reader's comprehension of the material read could be made more simply and accurately if the paragraph form were used.

The typewritten contents of the selections were transcribed into shorthand by expert shorthand writers. The selections of Groups I and II were written by Paul Moser, director of Moser Bus-

iness College and the selections of Groups III and IV were written by A. M. Puett, instructor in Voss Business School. The shorthand selections, their transcriptions, and the printed selection used in the study appear at the end of this chapter.

The Experimental Procedure

Oral reading.- The oral reading was done under excellent experimental conditions. The subject was comfortably seated at a table on which stood the dictaphone. The experimenter told the subject that she was to read before this machine a few passages of shorthand. He explained that the shorthand writing was very similar to that which she had been using in her class work. He assured her that her reading of this material was not a test on her work in her shorthand course and that the results of reading would, in no way, affect her marks or standing in any of her classes.

A few practical uses and the most important mechanical features of the dictaphone were then briefly and very simply explained. About one-fourth of the evening school students had had previous experience with the machine; accordingly, for them this explanation was merely a short review of facts which they already knew.

The experimenter next demonstrated for the subject how the mouthpiece of the machine should be held and the strength of voice which should be used in reading. He spoke one or two sentences into the mouthpiece and, after slightly adjusting the machine, asked the student to listen to the dictaphone reproduction of the sentences. The student was then asked to read a few printed sentences into the mouthpiece and to listen to their reproduction. This reading was done in order that the student might try out her own voice and set herself at ease in this manner of reading. It also served to show the experimenter whether the student

read with sufficient vocal intensity and clearness. In a few instances the first attempt at such reading was unsatisfactory; in all of these cases the second trial, which was preceded by suggestions for improvement, was entirely successful.

After this preliminary experience with the machine a shorthand selection was handed to the student who was asked to place it on the table in the position in which she could read it easily. Then, while the shorthand writing was concealed from view, the student was instructed as follows:

> Please read these few lines of shorthand in the same way and speed at which you ordinarily read shorthand in your class exercises. Read carefully and in a voice about as loud as you used in reading the printed sentences. If you come to a character which is hard for you, take such time as you need in reading it. If you use a great deal of time on a difficult character, I may give you a little help on it. Of course, you are to read without help as much as possible. You will probably need very little help, or perhaps none at all. Now see how well you can read the shorthand. You may begin.

Each of the students read either three or four selections of shorthand and the printed passage, Selection V, at one sitting. Between consecutive readings about five or six minutes elapsed during which time the student generally made casual comment on the selection, her success in reading, or some other matter of momentary interest to her.

The order in which the selections of a group were read was varied for the different readers. For example, the first selection of Group I was read first by approximately one-third of the students in Group 1; it was second among the selections read by another third of these students and last in the shorthand reading done by the remaining students of Group 1. The other two selections of Group I and those of the other groups were rotated in the reading in a similar manner. The printed selection was generally read after the first or the second shorthand selection.

On the whole, the dictaphone reading was done very satisfactorily. There were no interruptions in the reading and apparently no emotional disturbance of the readers. The dictaphone was mechanically adjusted so that it was constantly ready to record everything that was spoken by the subject during the reading. The cylindrical records from the reading, when used on the transcription machine, gave clear and complete records of the reader's entire vocal performance.

A stop watch was used in determining the length of time required by the readers on each of their selections. By the same means the length of time elapsing in very long pauses of the readers was determined. When a reader had paused for 25 seconds, she was prompted, by the experimenter, with the meaning of the character causing difficulty.

Silent reading.- Three times within the school year the day-school students readbefore the eye-movement camera one or two of the shorthand selections. An interval of approximately three months elapsed between consecutive readings. At the third reading Group D read two selections, IVc and IVd. Also at this reading each group read the printed passage, Selection V, before reading the shorthand material. The experts read the shorthand and printed selections in the summer following the completion of the student readings.

The photographing of the eye movements of both students and experts was done under good experimental conditions. Before reading the first shorthand selection each subject read, before the camera, a brief passage of printed discourse and two or three lines of shorthand material similar to those of the prepared selections. This exercise served generally to relieve such strain or embarrassment as the reading position and novel experience with the camera would otherwise have caused. After the regular short-

hand selection had been properly placed before the student, but concealed temporarily from view, she was instructed as follows:

> Now you are to read a short paragraph (or two) of shorthand. There are (four, five, six, or seven) lines. Be sure that you read it slowly enough to get the meaning of each sentence. However, read it as rapidly as you can, provided you are getting the full meaning of what you read. Try to complete the reading of one line before going to the next one. However, you may look back at any part of the line directly above the one which you are reading if you need to do this. Please close your eyes just as soon as you have finished the last line.

After the reading was finished the student was asked a series of short questions (from six to nine) based upon the material read, to ascertain how well she had understood the meaning. The first of the questions invariably was stated affirmatively, thus: "Now tell me what the selection was about." The remaining questions were on details of the selection; hence they were necessarily varied to accord with the contents of the respective selections. In a majority of the cases, the subject's replies to the general question and to three or four detail questions showed whether the reader had apprehended the true meaning of the various sentences. If the subject's replies were such as to cause doubt in the experimenter's mind regarding her understanding of the selection, she was asked to read aloud a few phrases or parts of sentences indicated to her. If she failed to do this readily, she re-read the entire selection before the camera. Then her comprehension on the second reading was tested in a manner similar to that of the first reading. In cases of rereadings the record of the second reading only was used in the group results. A surprisingly small number of rereadings proved necessary, there being but five of such readings among a total of 213 shorthand readings.

The degree to which the replies of the subjects indicated that they had comprehended the material read is indeed encouraging. In virtually one-fourth of the readings the subjects gave, in re-

sponse to the first question, a nearly verbatim reproduction of the contents of the selection. In all other cases, excepting the five rereadings above noted and a few other cases in which the comprehension was apparently weak, the subject's understanding of the meaning of the selections read was considered entirely satisfactory. However, careful note was made of all readings which seemed to have been unaccompanied by a high degree of comprehension. Reference to the nature and extent of some of these readings will be found in its proper connections in this report.

In general, the students exhibited a very thorough comprehension of the materials read. This result may be largely due to two factors: first, the selections were short and their sentence meanings fairly well interrelated; and second, the minute and detailed analysis ordinarily employed in the careful reading of shorthand necessarily makes for vivid and complete understanding.

The photographing reading of the printed passage and the consequent testing of the reader's comprehension were done in a manner similar to that used with the shorthand selections.

The photographic records of the silent reading of all students were charted or plotted. Plottings were made from all of the records excepting those from the readings of Selections Ic, IIc, IIIc, IVc, and IVd. From the reading of these five selections, four typical records (two very good and two very poor ones) were selected and plotted. The remaining records from the reading of these selections were charted. All of the expert's records of their silent reading were plotted.

The Photographic Apparatus and Method

The photographic records used in this study were obtained by means of a large binocular camera equipped with a kinetoscopic film attachment. Beams of light from a tungs-arc bulb were reflected, by two silvered-glass mirrors, respectively to the cornea

of the reader's left eye and to a metallic bead fixed on a spectacle rim at the outer corner of her right eye. From the cornea and the bead the light was projected into the camera lens and brought to a focus on the moveable film at the read of the camera. By means of two lenses, each of which had a twelve-inch focus, the rays of light reflected by the eye and those reflected by the bead were focused independently on the camera film. The focusing was effected through a series of varied mechanical adjustments of the lenses.

The movements of the reader's eye, as it traversed the lines of reading material, changed slightly the direction of the reflected light which was focused on the moving film. An electrically-driven tuning fork making 25 vibrations per second was stationed directly in front of the source of light. At each vibration of the fork the light was interrupted; consequently the intermittent beam, reflected from the cornea, produced a series of dots as it fell upon the film. A single fixation of the eye made by the reader thus produced a number of dots, each of which represents one-twenty-fifth of a second. Similarly the successive fixations of the eye, as it proceeded horizontally along the line, produced a series of short, dotted lines. As the bead remained stationary its image produced a continuous line of dots which were recorded lengthwise on the vertically-moving film. This line of dots served as a reference line by means of which the head movements of the reader were detected.

The film containing the records of the eye movements was developed in the usual manner. By this means it was made impervious to the effects of light when exposed and the dotted lines representing the eye fixations were made visible. A projecting lantern fitted with reels for rotating the film and a screen for

holding in focus a copy of the reading material were used in plotting the records of the eye movements.

Records on Enlarged Plates

In the plotted records of the shorthand reading the characters appear twice as large as those used in the selections. This enlargement was necessary in order to provide sufficient space for recording the positions of the numerous fixations made by many of the readers. The enlarging was done by photo-engraving a copy of the original selections in which the interlinear space had been perceptibly widened. Hence, in the enlarged plates the characters and the spaces between them are twice as large and the interlinear spaces are more than twice as great as are the corresponding characters and spaces in the reading selections.[1]

The data represented by the photographic film were recorded on the enlarged plates in a manner described as follows. In plotting the film an exact reproduction of the reading selection was necessarily used on the screen. Pencil records of about half of the readings were plotted directly upon photographic copies of the selections. The markings on these records, indicating the line positions of the fixations and their numbers and duration, were reproduced in ink on the enlarged plates. This work was done with great care in order to make the markings on the enlarged characters correspond precisely to their positions on the normal-size characters of the pencil records. The plates from the other readings were prepared by reproducing in ink the pencil plottings which had been made directly upon the enlarged characters.

Most of the plates provide records of the eye movements made in reading the first line of the selection. The writer wished to determine whether the reading of the first line of the shorthand

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[1]In the photostatic reproductions of the enlarged plates appearing in the thesis the characters and the spaces between them are slightly less than twice their original size.

selections differs appreciably from that of the other lines. A study of the records of the reading showed that in general fewer fixations per character were made in reading the first line than in reading the remainder of the selection. In addition, evidence of confusion and haste appeared more frequently in the reading of this line than in the others. Hence the first line reading was not considered to be representative of the reading as a whole and the eye fixations made on this line were not tabulated.

Explanation of Record Markings

The markings on the records indicate three important measures of eye movements. The short vertical lines show the positions of the fixations. The numbers above these lines indicate the numerical order in which the fixations were made, while the numbers below the lines denote the duration of the fixation pauses in units of one twenty-fifth of a second.

It should be observed here that the positions of the vertical lines denote the centers of the fixation areas rather than the precise locations of the fixations. The fixation areas vary somewhat in width; in some instances they are as wide as four letter spaces. In interpreting the plotted records, therefore, one should bear in mind that the vertical lines indicate the centers of the fixation areas as nearly accurately as experimental means will permit. In the records represented by the enlarged plates the fixations between characters are regarded as belonging to the nearest character provided they are not farther from the character than a distance equivalent to four letter spaces[1] which is approximately six millimeters. If they are farther away than this distance, they are considered as having been made in the space between the characters.

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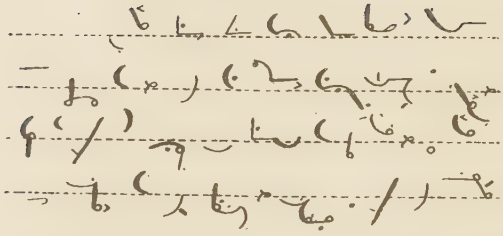
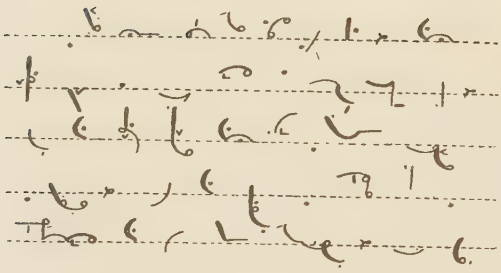
[1]Four letter spaces on the enlarged plates are equivalent to two letter spaces of normal dimension.

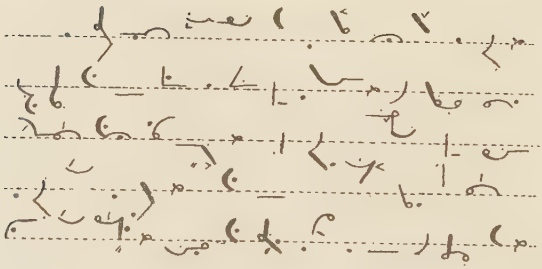
Selection Ia



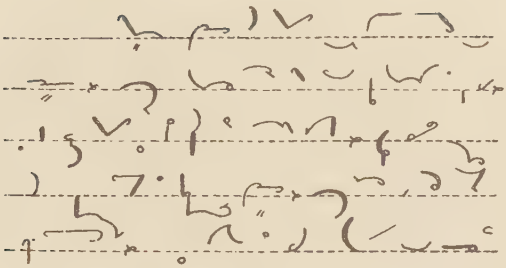
Selection Ib



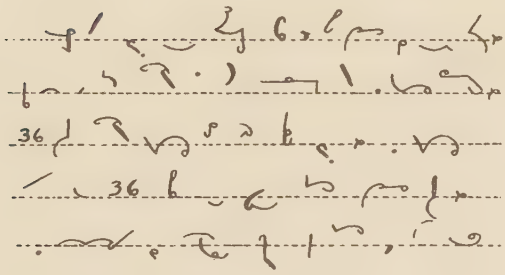
Selection Ic



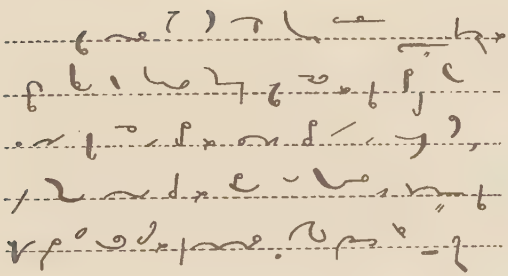
Selection IIa



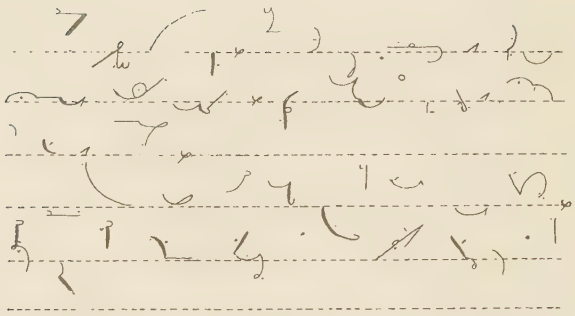
Selection IIa



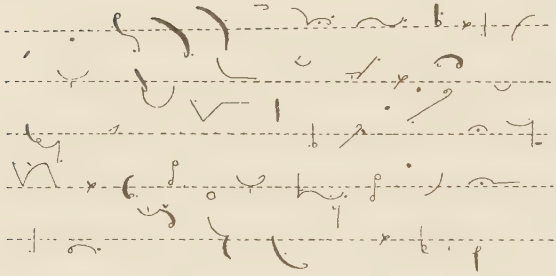
Selection IIc



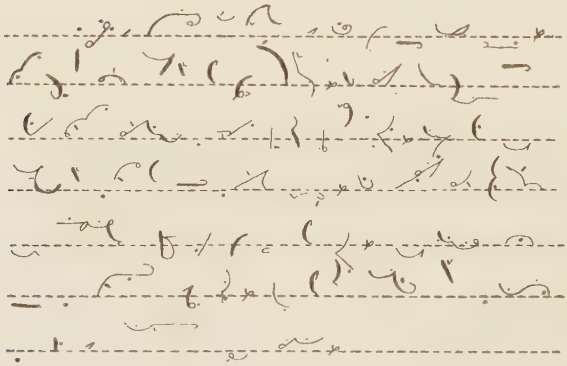
Selection IIIa



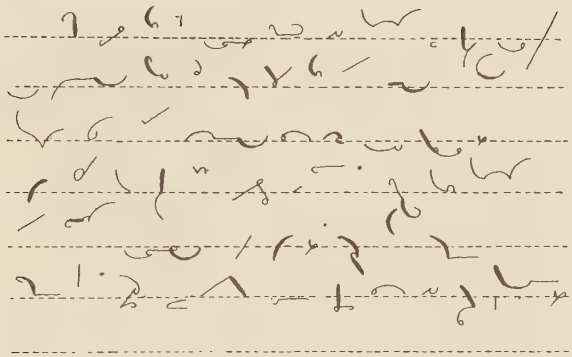
Selection IIIb



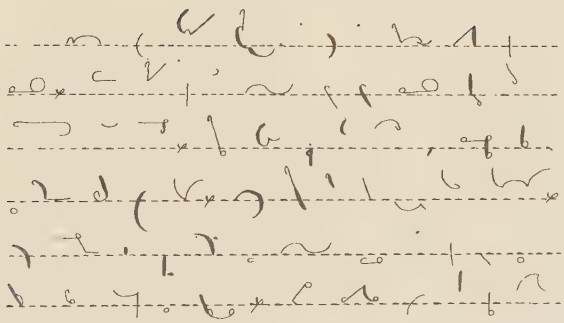
Selection IIIc



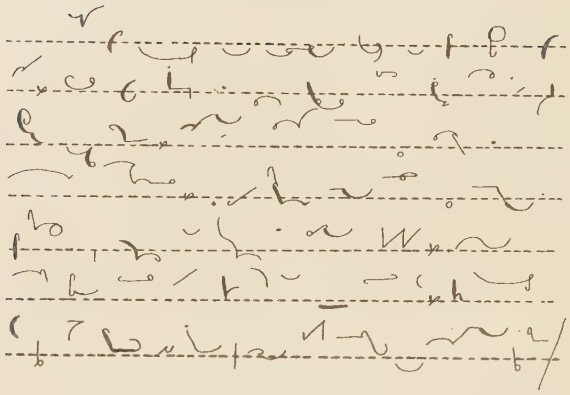
Selection IVa



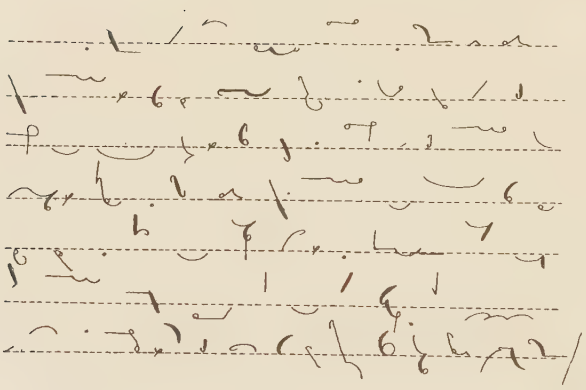
Selection IVb



Selection IVc



Selection IVd



Selection V

One night Peter went to bed early. It was not dark. The bright moon shone in at the window. Peter could see everything in the room. All at once he heard a noise. Peter opened his eyes. He saw that the room had grown dark. Something was outside the window.

Tap, tap, came a noise at the window. "What is it?" called Peter. "It is I, Peter. Come to the window." Peter climbed out of bed and went to the window. There he saw a bird. This bird was so large that his eyes were as big as saucers.

Verbal Content of Shorthand Selections

Selection Ia

If-the* boys take-the check they-may become dishonest and-the bank can dismiss them. Should they argue they-may-be uncouth and abusive. They-said that-the judge was too-hasty in taking them to-his office. His voice could-not induce them to-show decency. In-this-case the judge should expose

Selection Ib

The boys make some office sales each day. They-may decide to-buy a new house and move into it. If they desire advice they-may allow the bank to-invoice the business. Should they deceive the hostess at the customhouse they will become offensive. In this

Selection Ic

A dispatch came announcing that the boys may buy a ship. If-they do-this they could take a check to the bank. Should business seem irksome they-may sail to-Cuba. It should-be exciting to sink the ship on the beach. They could enjoy peace at some lake on Sunday. In-case they disobey the laws the kingdom should dismiss them.

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*The words joined by hyphens appear as phrases in the shorthand selections. The few words which are written in fourth position in these selections are also preceded by a hyphen and <u>to</u> or <u>too</u> in the context.

Selection IIa

Abraham Lincoln was born in-a log cabin in Kentucky. He-was-a famous man-and brought honor to his family and to-the world. The date when-he-was born is set aside as-an important holiday. This-date serves to-remind us to-admire the courage and determination of Lincoln. He was a-man of wise knowledge-and true character. His life has shown that there are no gains without

Selection IIb

Inside a large building in Washington there-is a statue-of Lincoln seated in-a chair. It-is made of white marble and was executed by a famous sculptor. Thirtysix tall marble pillars stand around-the outside-of-the building. The pillars are for-the thirtysix states in-the Union at-the-time-of Lincoln's death. The memorial is-a magnificent tribute to a-man whom all nations

Selection IIc

This immense hall was modelled after-a classic Greek temple. It-was designed by-the finest architect of-this continent. It-is said to-contain over a hundred different kinds of stone. Some-of-the stones are of unusual size, each weighing many tons. Standing on-the banks of-the Potomac it-is ideally situated as-the Nation's shrine. It commemorates the life-of Lincoln and-is-a good tribute.

Selection IIIa

We-acknowledge receipt-of-your letter today. You asked us to-assist the executor of-the estate in making-the necessary inventory. You-said nothing as to-the opinion of-the major or-the vote of-the council.

Week after next we-shall endeavor to-venture out on-a new policy. We-desire to-establish wide awake agencies and research boards here and at

Selection IIIb

The severe winter weather can-not remain many days. It will have no beneficial effect on-the country. The house in-the vicinity of-the park had its roof and rafters made into pulp. This circumstance is known to-many citizens and should make it seem unwise for-them to venture out. It-is-understood

Selection IIIc

A series of lectures on-the life of-the ancients will begin next week. Lately we-have had some knowledge about their use-of water power. Before the search for zinc began they-were slowly surveying the country to-establish its size and shape. Evidently they knew nothing about the laws that govern the earth and-moon. Patient research shows that-they roamed in-an extensive district each year with their sheep. New evidence may give the location of-this estate. If there was-an invasion by the enemy the date of-the encounter is not certain.

Selection IVa

Do-you realize that-you ought-to increase-the protection of-your family with additional insurance? In looking over-your assets we observe that-you are getting along fairly well and-are making some headway in-your business. Your chances for death and-your responsibility of care and provision for-your family are gradually increasing each year. We-believe that we-can work out an arrangement with-you whereby you-could discount some of-your bills to-the bank.

Selection IVb

You-may think that-you-are travelling an easy and permanent road to success. Quite contrary to what many people believe success depends upon character not accident. Perhaps they-have-not considered that-the man who succeeds does his work better-than-the-other fellow. He-was probably brought up in-a fine family. We expect him to-do away with many difficulties and to put his best efforts into his business. Such-a service will add to-his life.

Selection IVc

Undoubtedly you-are interested in increasing efficiency in-the delivery system-of your laundry. Unless you-have conducted a similar business you-cannot conceive-of-the mass of detail involved in-this work. Handling small accounts is simply a matter-of mathematics. The real problem-of cutting costs is keeping delivery promises to-the women on-the farm and surrounding territory. Many important telephone calls are delayed or not given careful thought. Do-you understand that it-is-the actual obligation of-your company to maintain hearty cooperation in marketing its product?

Selection IVd

The book which I-am sending-you describes the work of-a certified public accountant. This is-a growing profession and affords opportunities which do-not exist in any-other field. There-has been a scarcity of trained accountants for many-years. At-present the number-of certified public accountants in-the entire United States is-not sufficient to-supply the demand in New-York-City alone. The technical knowledge needed by-the accountant can-be secured at any large university at-a minimum of time and expense. Why do-not more young people prepare themselves for-this pleasant-and lucrative work?

CHAPTER III

THE ELEMENTARY PRINCIPLES OF MUNSON SHORTHAND

Introduction

Shorthand writing is in the expression of thought, or spoken discourse, by means of signs or symbols. It employs a system of characters ranging from simple to very complex in form. Several fairly complete systems of shorthand have been invented and more or less widely used. The Gregg and Munson are perhaps the best known and most generally used of the modern systems. The subjects of this study were trained only in the Munson system.

In this chapter an explanation of several of the important features of this system will be made. To any reader unacquainted with the structure and working principles of Munson shorthand, such an explanation may serve to clarify his understanding of the problems under investigation. Because of the limitation of space, however, only a few of the fundamental principles of this system of shorthand will be presented.

Symbols for Elementary Sounds

There are 40 distinct elementary sounds in the English language. In longhand writing and in printing, 26 letters are used to represent these 40 sounds. In Munson shorthand a brief sign or symbol is used to represent each elementary sound. Hence this system of writing, unlike printed and longhand expression, is phonetic. The elementary sounds include 24 consonant and 16 vowel sounds. In the Munson system there are two symbols for the consonant sound R; hence, there are 41 symbols for the 40 elementary sounds. These symbols and their sound equivalents are indicated in Table I.

The consonants are represented by straight lines and by quarters of a circle written at different angles. Thirteen of the consonant symbols, or stems, are made light to represent light or whispered sounds, and the other 12 are made heavy to represent loud or spoken sounds. Thus the light stem, ..\.. denotes the sound of p as in pay, while the same oblique line written with a heavy stroke, ..\.., represents b, as in bay. In general, the light and heavy consonant sounds of Munson shorthand parallel the soft and hard sounds in English pronunciation.

The vowels are represented by dots and dashes placed beside the consonant stems. Short vowel sounds are indicated by light dots and dashes and long vowel sounds are represented by heavy dots and dashes. The dashes, denoting long vowels, are always placed at right angles to their consonant stems. Thus in ..|.., denoting a as in at, and in ..\.., denoting u as in up, the dot and dash are made by a light touch and a light short stroke of the pen. Similarly in ..|.., meaning ate, and in ..|.., meaning oat, the dot and dash are made by a heavy touch and a heavy stroke.

Line Positions of Characters

In Munson shorthand the consonant stems are generally placed in one of three positions relative to the line of writing. In the first position the upright stems are written with the lowest point half of the height of the stem T above the line, as ..|.., ..\.., ../.., etc. In the second position the lowest part of the stem just touches the line, as ..|.., ..\.., and ../.. . In the third position the line divides the stem in the middle, as ..|.., ..\.., and ../.. . Horizontal stems in the first position are the height of the middle of the stem T above the line, as ..—.., ..—..; in the second position they are just above the line, as ..—.., ..—..; and in the third position they are just below the line, as ..—.., ..—.. . The fourth position is sometimes used to indicate

TABLE I

THE ALPHABET OF MUNSON SHORTHAND; SYMBOLS REPRESENTING THE FORTY ELEMENTARY SOUNDS

Light Consonants	Heavy Consonants	Light Vowels	
Pee p, as in pay	Bee b, as in bay	First Position ă, as in at	ŏ, as in hot
Tee t, as in tea	Dee d, as in day	Second Position ĕ, as in met	ŭ, as in up
Chay ch, as in church	Jay j, as in joy	Third Position ĭ, as in bit	ŏŏ as in book
Kay k, as in key	Gay g, as in go	**Heavy Vowels**	
Ef f, as in foe	Vee v, as in vie	First Position ä, as in calm	ạ, as in all
Ish sh, as in show	Zhee s, as in measure	Second Position ā, as in may	ō, as in no
Ith th, as in thigh	Dhee th, as in thy	Third Position ē, as in be	ōō, as in boat

TABLE I - CONTINUED

Light Consonants	Heavy Consonants	Compound Vowels (Diphthongs)	
Es .. s, as in so	Zee .. z, as in zeal	First Position .... i, as in my	.... oy, as in boy
Em . m, as in mow	Hay . h, as in hoe		.... ow, as in vow
En . n, as in no	Ing . ng, as in sing	Third Position .. ew, as in few	
Er .. r, as in oar	Way .. w, as in we		
Lee . l, as in low	Yay . y, as in yellow		
Ree . r, as in row			

that the word is preceded by <u>to</u> or <u>too</u>. A stem in the fourth position is written wholly below the line, as ....., to be, and ....., too few. With horizontal stems the fourth position is not used.

Position of Vowels

The marks used to represent the simple vowel sounds have three positions relative to their consonant stems. The first position is at the beginning of the stem, as in ..... Pa, and ..... ought. The second position is in the middle of the stem, as in ..... bay and ..... row. The third position is at the end of the stem, as in ..... be and ..... too. The four compound vowel sounds or diphthongs are denoted by marks placed in the first or third vowel-positions. In the first position occur ..... meaning i, as in ..... by, and ..... shy; ..... meaning oy, as in ..... joy, and ..... coy; and ..... meaning ow, as in ..... vow, and ..... cow. In the third position there is only one diphthong, ..., meaning ew, as in ..... due, and ..... cue.

As the consonant-stem outlines and their accompanying vowel markings constitute the basic symbols in the method of shorthand herein used, they have been presented above in considerable detail. Through combinations of these elementary symbols and by virtue of their different line positions a great number of varyingly complex characters may be made. Obviously, however, many additional forms for uniting the basic symbols and for representing a nearly endless variety of syllables, syllable combinations, and phrases must be employed by the shorthand student. In the following pages only a brief statement of the most general principles governing the forming of word outlines and the characters for word combinations will be submitted. Specific rules governing special cases in the writing and reading of symbols and characters will be referred to but not explained.

Throughout this thesis the word symbol is used to denote any simple shorthand form or outline which expresses a unit of meaning. A symbol may represent a vowel or consonant sound, a syllable, a word, or even a phrase. The word character is generally used to denote a combination of two more symbols in a single outline. A character may express two or more consonant sounds or syllables, a word, or a phrase combination of two or more words.

Joining Consonant Stems

Analysis of a great variety of words into their elemental sounds shows that virtually all words in the English language consist of one or more consonant and one or more vowel sounds. To this broad rule, however, a few one-syllable words having the sounds of pure vowels, such as aye, eye, oh, you, ewe, etc., are exceptions. In shorthand writing the word is analyzed phonetically and a symbol employed to express each phonic unit of the word. When written in sequence corresponding to the successive syllables of the word the symbols form a word outline or a character. In writing a word outline consisting of two or more stems, the stem symbols are joined one after another until the outline is completed and then the vowel markings are inserted. Thus in writing ....., meaning untie, the stem ..... n, is written first and then the setm ....., t is joined to it. Finally the vowel markings are inserted in the order in which the two stems are written and we have the completed outline, ... In reading word outlines, however, the vowel markings of a stem are generally read with the stem. As the full sound of the syllable is dependent upon the vowel marking of the consonant stem, reading the vowel along with the stem is necessary if the syllable is to be recognized readily. Vowels and diphthongs between stems are written in accord with special rules. An illustration of a simple vowel between stems

is the outline , meaning pack, and of a diphthong is , meaning dime.

Phrases and Phrase-Building

As stems are joined to form words so words are joined to form phrases. In shorthand a phrase is an outline representing a combination of two or more words whose outlines may be conveniently joined or abridged to form a single character. The words included by the shorthand phrase need bear no such grammatical relation to each other as is required by phrases used in ordinary written or printed discourse.

The first word of a phrase, if it contains a stem, is written in the position it would occupy if standing alone as , they may be, and , this day. Special rules govern phrasing in joining breves, in circles, loops, hooks, double-lengths, and half-lengths. The ability to combine words readily into phrases and to represent them in properly constructed phrase outlines is an important requirement of the shorthand writer. Likewise, the correct reading of these outlines in context is a valuable measure of reading skill. In the present study comparative analyses of the subject's eye movements in reading the phrases of the various selections have been made.

Word-Signs

In writing shorthand rapidly abbreviated outlines are used for a number of words, especially those occurring frequently. These contracted outlines are called word-signs. In constructing word-signs no rule indicates what parts should be omitted; however, in most of these characters the vowels are omitted and prominent consonants are retained. As the word-signs are merely arbitrary characters to represent certain words their perceptual outlines and meanings should be as thoroughly committed to memory as are the symbols denoting the consonant and vowel sounds.

Some of the most commonly used word-signs are ....., an, and; ....., a; ..... the; ..... had; ....., do; ....., can; ....., could; ....., shall; and ....., should. Naturally the complexity of the word-sign outline varies with the length and complexity of the words which they represent. To illustrate, the word-signs for administratrix, subscription, and delinquent are respectively, ..., ..., and ..... .

About 300 word-signs should have been mastered by the student during his first two semesters in high school. This body of word outlines together with a large number of their derivatives constitute a basic vocabulary of the shorthand writer and reader. In the shorthand writing used in this study an average number of nine word-signs for each selection may be found. Repetitions of a few of the word-signs appear in several of the selections. These repetitions together with the word-signs once used constitute roughly one-seventh of the entire content of the selections. The relative ease or difficulty with which students read word-signs and other types of characters, as indicated by measures of their eye movements, is discussed in later sections of this thesis.

Modifications of Elementary Symbols

As previously indicated in this chapter, the foundation elements in Munson shorthand are the symbols representing the consonant stems and the vowel sounds. In writing, the consonant stems may be directly modified in two ways to denote needed meaning. By reducing the stem to one-half of its regular length or by adding a symbol one-half as long as the original stem, the sound of t of d is added. The reduced or added stems are termed half-lengths. Thus ....., meaning may, when reduced to half length becomes ....., meaning made; and ....., meaning l, becomes ....., meaning left.

The curved stems may be extended to twice their regular length. These elongated characters are termed double-lengths. Double-lengths denote the addition of the syllables -ter, -der, -ther, -tor, or -ture to the original meaning. Thus the symbol ....., denoting af, when doubled becomes ....., meaning after, and .... denoting f, becomes .... meaning feather. The particular syllable which is added by a double-length naturally depends on the context in which it occurs. The specific rules governing the line positions in which half-lengths and full-lengths are written, and the principles regulating their use in phrasing and with the s-circles and final hooks can scarcely be included in this report.

The S-Circle and Its Modifications

In writing and reading shorthand some of the consonant stems are used much more often than the others. The consonant sound, or stem, which is perhaps most often used in spoken discourse is that of the letter s. Consequently in shorthand the symbol denoting this stem is used very frequently. As a basic consonant stem the sound of this letter is represented thus, ... (Table I, page 30). However, for speed and legibility in writing, as well as for ease in reading, the sound of s is denoted by a small circle, ... It is written on the right side of upright stems, ..., ..., ..., on the upper side of horizontal stems, ..., ..., and on the inside of curved stems, ..., ..., ..., ..., ... The s-circle is also used to express the sound of z when the latter is the last sound of the word.

In words of two or more syllables the s-stem occurs frequently between other consonant stems. The s-circle between stems is written in the manner described below (20).

Between straight stems forming no angle, the circle is written on the same side as when attached to a single stem; as, decide, tacit.

Between straight stems forming an angle, the circle is written on the outside of the angle; as, dispose, expose.

Between a curved stem and a straight stem, the circle is written inside the curved stem as: dismay, music.

Between two curved stems the circle is generally written inside the first; as, losing, amusing.

The s-circle is modified to form three other characters, the large circle, the small loop, and the large loop. They are written to the stem in the same manner as is the small circle. When written initially they are read first and when written finally they are read last.

The large circle represents any two sounds of s or z with an intervening vowel, e.g., ses, sez, zes, zez, etc. It is used initially, as schism; between the stems, as exist; and finally, as uses.

The small loop, called also the stee-loop, is made one-third of the length of the stem. It denotes the sounds of st and zd. Examples of its use are stock, list, and excused.

The large loop, also called the ster-loop, is made two-thirds of the length of the stem. This character denotes the final syllables -ster, -stor, and -sture. Examples of the large loop are poster, muster, and semester.

The writing and reading of the large circle and loops between stems and in phrases are done in accord with several specific rules which are not presented here.

Final Hooks

As the student proceeds with the study of shorthand he encounters an increasing number of contracted or abridged word outlines. Conspicuous among these are two small and two large hooks which are used at the end of stems and hence termed final hooks.

The small final hooks consist of the n hook and the f hook. A small hook placed on the side opposite the circle in straight stems, and on the inside of curved stems, denotes the sound of n, as pen, and gaining. A small hook written on the circle side of straight stems is used to represent the sound of f or v, as pave, cuff, and achieve.

The large final hooks extend slightly less than one-half the length of the stem. Their names, the shun-hook, and the ter-hook, denote generally the syllables for which they are written. The shun-hook is written on the circle side of straight stems and on the inside of curved stems to represent the syllables -tion, -tian, -sion, - cian, -cion, etc. This hook is illustrated in option, motion, and optician. The ter-hook is a large final hook written on the side opposite the circle on straight stems, as in writer, and picture. In writing and reading final hooks in various character positions such as in final hooks used medially, preceding circles, and in phrasing, other specific principles must be observed.

In the foregoing sections of this chapter an attempt has been made to describe and illustrate some of the most essential elements and working principles of Munson shorthand. Several important topics have been intentionally omitted from the discussion. However, it is hoped the treatment of those included is adequate to convey a fair impression of, at least, the elementary features of this system of shorthand.

CHAPTER IV

NUMBERS, DISTRIBUTION AND NATURE OF ERRORS MADE IN THE ORAL READING OF SHORTHAND

Introduction

In this study the dictaphone has been used to secure evidence on the nature and extent of the difficulties which students experience in the oral reading of shorthand. The data so obtained throw considerable light on the complex character of this kind of reading. They supplement the facts provided by photographs of the eye movements made in reading and reveal the causes of many of the movements. Together the two bodies of data enable one to picture clearly and accurately the most essential perceptual processes involved in reading of this type.

In this chapter and the following one the data obtained by use of the dictaphone are presented and interpreted. Wherever possible, the interpretation is made on the basis of related evidence provided by the records of the eye movements made in the silent reading of the corresponding selections.

It is the purpose of the present chapter to report the kinds and numbers of errors made by the oral readers and to describe the specific nature of these errors. In this connection typical records from the reading will be used to illustrate the nature and extent of the errors made by individual readers.

Kinds of Errors

An analysis of the transcribed records from the oral reading shows that the students made five distinct kinds of errors. These are described briefly below.

Failure to read characters.- One or more students failed to read 145 of the characters contained in the 13 selections. These failures represent two types of errors: (1) omission of characters, and (2) extreme delay or hesitancy in reading resulting in the experimenter's prompting the student with the meaning of the troublesome character. The prompting was not done, however, until the student had paused for at least 25 seconds. This length of time was considered sufficient for the student to show whether she could interpret the character within the limit demanded by even approximately effective reading. Further time and effort on the character would probably have added to the student's confusion and so handicapped her in reading the rest of the passage. The students experienced delays with promptings about 2.5 times as often as they erred by omitting characters. Together, the errors of delays and omissions constitute 25.4 per cent of the total number of errors.

Misreading of characters.- The errors of misreading fall into two types: (1) total misreading of the character after which the student failed to correct her mistake, and (2) initial misreading of the character followed by correct reading. The errors of these two types comprise 56.6 per cent of all errors made. The students completely misread characters approximately three times as often as they misread them with corrections.

Rereading of characters.- A fifth type of error consists of rereading the character or characters last read. Generally in the rereadings the characters were reread only once. However, in a few instances the meanings of characters were repeated two or three times. Such repetitions do not appear to be rereadings. They were probably made somewhat thoughtlessly by the student while her attention was on the next character. In fact, many of

the errors listed as rereadings may have been thus made. However, it was impossible to determine whether the errors of rereading, so-called, were due to the actual rereading of the character, or to the mere repetition of its meaning as an aid in interpreting the next character.

Number and Distribution of Errors

A total of 860 errors were made in the oral reading of the 13 selections. Together the selections contain 766 characters. Errors were made, by one student or another, on 589 of these characters or on 76.9 per cent of the entire contents of the selections. Thus the errors are not concentrated about a few difficult characters but are distributed widely over the whole body of reading material. Table II shows the numbers of the various kinds of errors made by each student.

It should be recalled that the 30 students whose records are here reported comprise four groups, each of which read a different group of selections. Three of the groups contained three selections each, while the fourth consisted of four selections. The selections composing each group were sufficient in length and difficulty to require the serious efforts of the students in reading them.

The horizontal spaces in the table serve to set apart the records of the different groups. The records of groups 1 and 2, consisting of beginners in shorthand, appear in the upper half of the table. Group 1 read material which was vocalized or contained the vowel markings and Group 2 read unvocalized material. The third division of data is that of the intermediate students and the last division represents the records of the advanced students. The material of one of the selections read by the intermediate students was vocalized and that of the other two selections was unvocalized. The advanced students read only unvocalized material.

TABLE II

KINDS AND TOTAL NUMBERS OF ERRORS MADE BY EACH OF THIRTY STUDENTS IN READING SHORTHAND ORALLY

Students	Omissions	Corrected Misreadings	Rereadings	Delays with Prompting	Uncorrected Misreadings	Total Number		Per cent of Error in Reading
						Errors	Characters in Selections Read	
1a	0	0	0	2	14	16	141	11.3
1b	3	3	0	1	10	17	141	12.1
1c	1	3	6	1	16	27	141	19.1
1d	1	3	3	2	7	16	141	11.3
1e	0	1	0	0	12	13	141	9.2
1f	0	4	3	10	11	28	141	19.9
1g	1	6	8	0	10	25	141	17.7
1h	2	1	0	0	6	9	141	6.4
1i	0	4	4	9	12	29	141	20.6
1j	0	1	2	4	3	10	141	7.1
2a	1	0	1	5	2	9	162	5.6
2b	2	2	7	8	8	27	162	16.7
2c	1	3	3	1	13	21	162	13.0
2d	1	1	2	6	5	15	162	9.3
2e	1	3	3	10	8	25	162	15.4
2f	0	1	5	2	6	14	162	8.6
2g	1	4	4	6	6	21	162	13.0
3a	3	6	3	2	10	24	177	13.2
3b	1	4	2	6	15	28	177	15.8
3c	0	1	3	9	7	20	177	11.3
3d	1	2	5	3	4	15	177	8.5
3e	3	4	8	2	12	29	177	16.4
3f	2	7	2	0	18	29	177	16.4
4a	4	16	14	5	24	63	286	22.0
4b	7	10	19	17	27	80	286	28.0
4c	2	11	12	8	16	49	286	17.1
4d	4	1	7	15	10	37	286	12.9
4e	4	5	5	7	13	34	286	11.9
4f	4	11	18	14	38	85	286	29.7
4g	5	6	6	8	20	45	286	15.7

That the students differ widely in their capacity to read shorthand is evident from the foregoing table. The numbers of errors per student range from nine errors made by two beginning students to 85 errors which were made by an advanced student. The ten students who read most accurately made a median number of 15 errors, and the ten who read least accurately made nearly three times as many or a median number of 41 errors. The median for the 30 students is 23.8 errors per student.

Eighteen students made five kinds of errors, nine made errors of four kinds, and the other three students made two or three kinds of errors. Thus, the students vary less widely in the variety than in the numbers of errors which they made.

The per cents of error, which are indicated in the last column of Table II, range from 5.6 per cent to 29.7 per cent. The student who made the largest number of errors read approximately five times as inaccurately as the student who made the best record in reading. The median per cent of error for the 30 students is 13.7.

The first four columns of data in Table III indicate the extent to which the various kinds of errors were distributed among the 30 students and over the materials of reading. Columns 5 and 6 give the numbers of errors of each kind and their per cents of the total number.

The uncorrected misreadings are the most numerous as well as the most widely distributed of all errors. Nearly half of the errors (42.2 per cent) were of this kind; and they were made by one student or another on more than one-fourth (27.4 per cent) of all of the material used.

TABLE III

NUMBERS AND DISTRIBUTION OF DIFFERENT KINDS OF ERRORS MADE BY FOUR GROUPS OF STUDENTS IN READING, RESPECTIVELY, FOUR GROUPS OF SHORTHAND SELECTIONS

Kinds of Errors	Students Making Errors		Characters Read with Error		Number of Errors		Coefficient of Error
	Total Number	Average No. of Errors	Number*	Per cent of Total No. of all Characters	Total	Per cent of Total	
Omissions of characters	23	2.4	41	5.4	55	6.4	.010
Delays requiring prompting	26	6.3	104	13.6	163	19.0	.029
Uncorrected misreadings of characters	30	12.1	210	27.4	363	42.2	.065
Corrected misreadings of characters	28	4.4	112	14.6	124	14.4	.022
Rereadings of characters	26	6.0	122	15.9	155	18.0	.028
Total	30		589		860	100.0	.154

*The term, number of characters read with error, as used in this study does not mean the number of distinctly different characters so read. Among the 41 omitted characters, stated in column 3, the character for the has been counted three times. This character, like several others, appears in different contexts and in different selections. Hence each character read erroneously was counted once for each context in which it was so read.

Reading delays resulting in prompting represent nearly a fifth (19 per cent) of the total number of errors. The characters which were prompted to one or more students include about one-seventh of the reading material. Slightly less than one-fifth (18 per cent) of the errors were due to rereading; and about one-sixth of the material was reread by one student or another.

The other two kinds of errors represent relatively smaller proportions of the total. Misreadings which were presently corrected by the students and the omission of characters represent respectively about one-seventh and one-sixteenth of all errors. Figure 1 shows graphically the relation of the various kinds of errors to the total number.

The last column of Table III presents a specific measure of each of the kinds of error as they relate to total failure in reading. By the term, coefficient of error, is meant the ratio of the number of errors of a given kind to the total number of possibilities for making such error. By multiplying the number of characters in a selection by the number of students who read it, the total number of possibilities for errors of a given kind is obtained. In the combined reading of all students the total number of possibilities for omitting a character is 5608. Table III shows that a total of 55 errors of omission were made. The ratio of 55 to 5608 is .010 which is the coefficient of the error of omission. This amount of error means that by omitting characters the students made one one-hundredth of the number of errors that they would have made by omitting all characters. Such omission would have meant, of course, total failure in reading.

The data representing the coefficient of error may perhaps be more easily and clearly interpreted in their relation to perfect reading. For example, the coefficient of the error of omission,

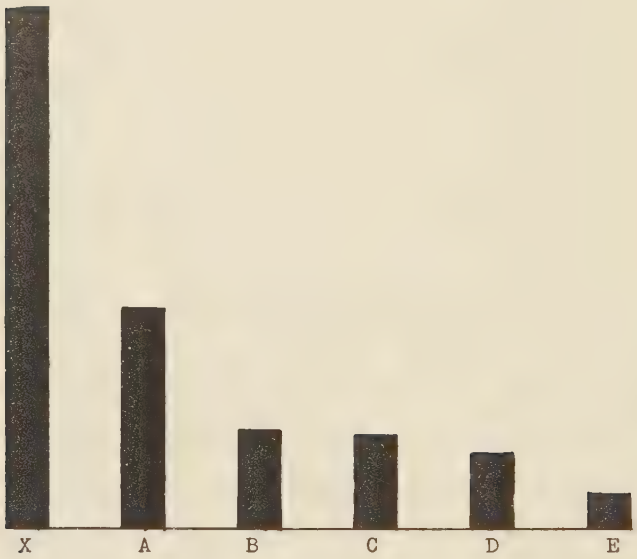


Figure 1. Graphical representation of the numbers of different kinds of errors in relation to the total number of errors. The columns denote different kinds of errors as follows: X, errors of all kinds; A, uncorrected misreadings; B, delays requiring promptings; C, rereadings; D, corrected misreadings; and E, omissions of characters.

.010, means that had the students made only errors of omission, 99 per cent of their reading would have been correct. When, in the same manner, deduction is made for all of the errors the results show that 84.6 per cent of the reading of the 30 students was correctly done. Thus, in point of accuracy of interpretation, the oral reading was at least moderately effective.

Errors of Rereading

The reread characters, 122 in number, represent nearly a sixth of all of the characters on which errors were made, and the rereadings comprise approximately one-sixth of the total number of errors. The numbers of rereadings per student range from one to 19 with a median of five rereadings for all students who made this kind of error. Only 19 characters were reread by more than one student, and but one of these characters was reread by as many as four students.

Examination of the records of the oral reading indicates that the characters which immediately follow the ones reread probably caused many of the rereadings. Table IV presents the acters which were most often reread and those which appear next in the context. Seven of the reread characters listed in the table are very common word-signs which should have presented very little difficulty to the reader. The characters following them in the context, however, are generally quite unlike them in construction and are much less frequently used. The records of the students who read silently the selections containing these characters show that 1.6 times as many fixations were made on the characters following the word-signs as on the word-signs themselves. These records show also that one-third of the students regressed from the following characters in reading the word-signs.

The records of the silent reading of the remaining twelve characters of the table, excepting ..... on-the, which is in the

TABLE IV

CHARACTERS REREAD BY TWO OR MORE STUDENTS IN THE READING OF FOUR GROUPS OF SELECTIONS

Characters Reread	Meaning of Reread Characters	Characters Following the Ones Reread	Meaning of Following Characters	Kinds of Reread Characters and Numbers of Rereadings			Students Rereading
				Word-signs	Phrases	Other Characters	
	and		move	2			1d, 1g
	and		surrounding	3			4a, 4b, 4f
	the		hostess	2			1i, 1j
	his		voice	2			1g, 1j
	of		wise	2			2f, 2g
	should		they argue	2			1c, 1f
	for		death	4			4a,4c,4d,4f
	probably		brought	2			4a, 4b
	before-the		search		2		3d, 3e
	that-the		man		2		3c, 3f
	he-was		probably		2		4a, 4b
	in-the		delivery		2		4d, 4f
	you-cannot		conceive-of-the		2		4d, 4f
	matter-of		mathematics		2		4b, 4c
	in-the		entire			2	4b, 4e
	they		deceive			2	1c, 1g
	we		observe			2	4b, 4f
	some		headway			3	4c, 4e, 4g
	you-could		discount		2		4a, 4b
Total				19	14	9	

first line of a selection, present a similar picture with respect to the numbers and order of the fixations made upon the reread characters and on those following them. An average number of ten students read the selections which contain these characters. These students made four-fifths as many fixations on the reread characters as on the next ones in the context. Two-fifths of the silent readers directed attention one or more times to the orally reread characters while they were attempting to interpret the following ones.

Analysis of the most frequently reread characters and the next ones in the context shows that the median number of elements in the former is 1.0 and in the latter 2.7. Hence the reread characters of Table IV are, on the whole, much simpler in construction than those which follow them. It is probable that many of the regressive fixations made by the silent readers on the orally reread characters represent partial or entire rereadings of those characters.

The facts presented in this discussion indicate that rereading, repetition of meanings, or some form of review of many of the characters is a common accompaniment to reading. In the light of all available evidence on the nature of the rereadings or repetitions, these errors in the oral reading appear to have been made in the manner, and for the reasons, stated below.

First, the meanings of some of the characters, generally the simpler ones, were repeated while the reader was trying to interpret the next character. These verbal repetitions, whether made unwittingly or intentionally, revived in the reader's mind the thought of the immediate context and so helped her in interpretation.

Second, in the misreading of some of the characters the reader noticed that the meaning rendered did not fit logically with

the meaning which she had given to the previous character. In such cases, she carefully reread the previous character in order to verify the correctness of the first reading.

Third, several of the characters next after those reread were interpreted at great expense of time and effort. Meanwhile, the reader forgot the meaning of the previous character; hence she naturally reread it to recover the thought of the context and regain momentum in reading.

Errors of Omission

Twenty-three oral readers omitted one or more characters in reading; however, ten of these readers omitted only one character. Thus, nearly all of the omissions were made by 13 students or less than half of those who read orally. The reader who made the largest number of omissions, which is seven, was an advanced student.

Table V shows that the errors of omission are distributed evenly among word-signs, phrases and other characters. The frequent usage of word-signs in shorthand should make them easy to read; but the abbreviated form of these characters gives to them an element of pronounced difficulty. Half of the omissions of word-signs, or nine errors, were made by six students who failed to read the small characters, ... the, ... and, and ..... of. The size of these symbols and their proximity to the line of writing may have rendered them obscure to some of the readers. However, no data are available to show whether any of these characters was omitted through the reader's failure to see it. Nevertheless, the records of the students who read silently the selections containing these characters show that ten readers did not give direct attention to ..... the; two did not look directly at ..... and, four did not see ..... of directly. Five other characters .....,

TABLE V

CHARACTERS OMITTED BY FOUR GROUPS OF STUDENTS IN READING FOUR GROUPS OF SELECTIONS

Characters Omitted	Meaning of Omitted Characters	Types of Characters Omitted and Number of Omissions			Students Omitting
		Word-Signs	Phrases	Other Characters	
*	the	5			1g, 1h, 3a, 4b
	and	2			3b, 3e
	of	2			2b, 2g
	your	2			4a, 4d
	opinion	2			3a, 3f
	people	1			4d
	for	1			3e
	kingdom	1			1b
	similar	1			4b
	knowledge	1			4b
	increase-the		3		4b, 4c, 4f
	system-of		3		4a, 4d, 4e
	to-Cuba		2		1b, 1d
	to-admire-the		2		2b, 2e
	man-and		1		2d
	this-date		1		2a
	to-the		1		3f
	on-the		1		4e
	that-you		1		4f
	for-your		1		4a
	do-not		1		4b
	to-venture		1		3e
	entire			1	4g
	life			2	4c, 4d
	laundry			2	4a, 4d

TABLE V (Continued)

Characters Omitted	Meaning of Omitted Characters	Types of Characters Omitted and Numbers of Omissions			Students Omitting
		Word-Signs	Phrases	Other Characters	
	uncouth			1	1c
	peace			1	1b
	temple			1	2c
	inventory			1	3d
	awake			1	3a
	at			1	3b
	travelling			1	4d
	business			1	4b
	involved			1	4g
	actual			1	4g
	technical			1	4b
	needed			1	4b
	why			1	4b
	themselves			1	4f
Total 39		18	18	19	23

*This character was omitted in three different contexts. Each of the others was omitted in one setting only.

..., ..., ..., and ..., which were omitted in oral reading, were not fixated directly by one or more of the silent readers.

Table VI shows the extent to which the various characters omitted in oral reading were seen or not seen directly by other students in the silent reading. Examination of the table reveals that 26 characters or approximately two-thirds of all those omitted did not escape the direct attention of any student who read silently the selections in which they appear. On two of these characters, ... kingdom and ..... business, the readers made a median number of one fixation per character. The median numbers of fixations made on the other 24 characters range from 2.3 to 9.5. Thus the silent readers made definite attempts to read directly nearly two-thirds of the characters which one or more oral readers omitted, and they made much larger numbers of fixations on the more complex and less frequently used characters.

The errors of omission in oral reading were made then; (1) on a small number of characters which probably escaped the notice of the reader, and (2) on a much larger number of characters which the students attempted to interpret but finally omitted because of their difficulty.

Two factors may be held largely responsible for the student's failure to notice the character. They are (1) the size and position of the character as illustrated above, and (2) the confusion or emotional disturbance of the reader which originated in interpreting the previous character. In this study no objective facts could be secured on the nature and extent of disturbances which may have caused students to overlook characters in their oral reading. That such confusions existed is very probable in light of the fact that the records of the silent reading show numerous instances of erratic and bewildered attempts at reading. A third

TABLE VI

NUMBERS OF EYE FIXATIONS MADE BY THE SILENT READERS ON THE CHARACTERS* WHICH WERE OMITTED BY ONE OR MORE ORAL READERS

Omissions by Students Reading Orally			Fixations by Other Students Reading Silently		
			Number of Students		Median No. of Fixations per Character Made in Silent Reading
Characters Omitted	Meaning	No. of Students Omitting	Making no Fixations	Making Fixations	
.....	the	5	10	26	1.0
.....	of	2	4	4	1.0
.....	and	2	2	10	2.0
.....	at	1	2	9	3.5
.....	people	1	5	6	1.2
.....	on-the	1	2	6	2.5
.....	themselves	1	2	7	1.0
.....	do-not	1	1	8	2.0
.....	kingdom	1	0	9	1.0
.....	business	1	0	8	1.0
.....	for-your	1	0	13	2.3
.....	this-date	1	0	9	2.4
.....	travelling	1	0	11	2.5
.....	why	1	0	9	2.5
.....	opinion	2	0	13	2.8
.....	awake	1	0	12	3.0
.....	man-and	1	0	9	3.2
.....	to-the	1	0	13	3.2
.....	actual	1	0	8	3.3
.....	similar	1	0	8	3.5
.....	laundry	2	0	8	3.5
.....	needed	1	0	9	3.5
.....	peace	1	0	9	3.7
.....	involved	1	0	8	3.7

TABLE VI (Continued)

Omissions by Students Reading Orally			Fixations by Other Students Reading Silently		
Characters Omitted	Meaning	No. of Students Omitting	Number of Students: Making no Fixations	Number of Students: Making Fixations	Median No. of Fixations per Character Made in Silent Reading
	to-admire	2	0	9	3.8
	the knowledge	1	0	9	4.2
	to-Cuba	2	0	9	4.2
	uncouth	1	0	10	4.3
	temple	1	0	8	4.5
	to-venture	1	0	15	4.6
	for	1	0	9	5.5
	entire	1	0	9	5.5
	inventory	1	0	13	6.5
	technical	1	0	9	9.5

*Five of the characters omitted by the oral readers appear in the first lines of the selections. These characters are not included in this table as the reading of the first line before the camera is not generally representative of the reader's performance on the rest of the selection.

factor, defective vision, might have led the reader to neglect small characters. However, each of the oral readers, when asked whether she could see all parts of the selections clearly, replied affirmatively; accordingly, the degree of error attributable to poor vision seems negligible.

The oral readers made no verbal response in their attempts at reading the characters which were omitted because of difficulty; hence their records afford no evidence on the nature of the trouble encountered. The records of the silent reading indicate that the difficulty presented by a given character varies widely with individual readers. In analytic reading it generally depends upon the following factors: (1) the reader's capacity to perceive the parts of the character accurately, (2) her ability to associate them readily with their meaning, (3) her alertness in recognizing the interrelations of the parts in a given setting, and (4) her skill in properly assembling them into a meaningful whole. Each of these factors is, in turn, conditioned by the mental powers of the student, the specific nature of her shorthand training, and the recency of her contact with the character under consideration.

Errors of Delays Ending in Prompting

The errors of delays which ended in prompting as well as the errors of omission show merely the negative side of the student's performance in reading. However, these errors mark out certain parts of the material which were the cause of many interruptions and difficulties in interpretation. In the present section the errors represented by delays necessitating prompting will be discussed. These errors cannot be explained fully because of the absence of specific evidence on the extent and nature of the student's failures in reading the prompted characters. Nevertheless, the errors are worthy of note since they were made by more than

four-fifths of the oral readers and represent collectively the unsuccessful reading of approximately one-seventh of all characters in the selections.

The number of promptings per student ranges from one to 17 with a median of 6.3 promptings for all students making this kind of error. The numbers of promptings per character when all students are considered range from one to five; however, only 32 of the 104 prompted characters were interpreted for more than one student.

In Table VII the characters which were prompted to two or more students are presented. The table shows that about one-seventh of the errors represented by the promptings of these characters was made on word-signs, roughly one-fifth of them was made on phrases, and the remainder, which is approximately seven-tenths of the total, was made on other characters containing one or more consonant stems. Only two word-signs, two phrases, and six other characters were prompted to more than two students. Thus, only ten characters, or less than 10 per cent of the total number of prompted characters, caused delays to as many as three students.

Twenty-four of the prompted characters listed in Table VII caused other kinds of errors in reading. These characters are reproduced in Table VIII. Examination of this table shows that four kinds of errors were made on four of these characters and that three kinds of errors were made on ten others. Thus 14 of the characters which caused delays necessitating prompting were the sources of two or three other types of difficulty in the oral reading. The records of the silent reading of these characters show that seven of them received much more than average attention from the readers. The characters and the average numbers of fixations made upon them are: ..... knowledge-and, 3.4; ..... dishonest, 3.7; ..... to-admire-the, 3.8; ..... lucrative, 4.1; ..... certi-

TABLE VII

CHARACTERS PROMPTED TO TWO OR MORE STUDENTS IN THE ORAL READING OF FOUR GROUPS OF SELECTIONS

Characters Prompted	Meaning of Prompted Characters	Types of Characters and Numbers of Promptings			Students Prompted
		Word-signs	Phrases	Other Characters	
	opinion	2			3b, 3c
	New-York-City	2			4c, 4d
	opportunities	3			4b,4d,4f
	United-States	4			4b, 4d 4e, 4f
	knowledge-and		2		2d, 2g
	he-was		2		4c, 4f
	system-of		2		4d, 4f
	entire		2		4b, 4e
	to-admire the		3		2a,2b,2e
	to-contain		4		2b, 2e, 2f, 2g
	desire			2	1f, 1e
	hostess			2	1i, 1j
	irksome			2	1f, 1i
	decency			2	1b, 1c
	date			2	2e, 2g
	wise			2	2a, 2b
	true			2	2a, 2g
	ideally			2	2d, 2e
	boards			2	3b, 3c
	patient			2	3b, 3c
	travelling			2	4a, 4f
	not			2	4c, 4d
	hearty			2	4b, 4d
	certified			2	4a, 4b
	growing			2	4c, 4g
	scarcity			2	4d, 4g
	laundry			3	4e,4f,4g
	affords			3	4b,4d,4f
	responsibility			3	4b,4e,4g
	immense			4	2b, 2e, 2f, 2g
	lucrative			4	4b,4c,4e,4f
	dishonest			5	1d,1f,1g,1j
Total 32		11	15	54	26

TABLE VIII

PROMPTED CHARACTERS WHICH CAUSED OTHER KINDS OF ERRORS IN THE ORAL READING OF FOUR GROUPS OF STUDENTS

Promptings		Number of Students Prompted	Other Kinds of Errors and Numbers of Students Making Them				Total Number of Students Making Errors
Characters	Meanings		Omissions	Repetitions	Corrected Misreadings	Uncorrected Misreadings	
	New-York-City	2				1	3
	date	2				1	3
	wise	2			1		3
	boards	2			1		3
	hearty	2		1			3
	hostess	2				2	4
	irksome	2				2	4
	decency	2				2	4
	not	2				3	5
	laundry	3	2				5
	knowledge-and	2		1			4
	entire	2	1			1	4
	travelling	2	1		1		4
	ideally	2			1	2	5

TABLE VIII (Continued)

Characters	Meanings	Number of Students Prompted	Other Kinds of Errors and Numbers of Students Making Them				Total Number of Students Making Errors
			Omissions	Repetitions	Corrected Misreadings	Uncorrected Misreadings	
	certified	2			1	2	5
	to-admire-the	3	1			1	5
	responsibility	3			1	2	5
	United-States	4		1		1	6
	to-contain	4		1		1	6
	immense	4		1		1	6
	opinion	2	2	1	1		6
	he-was	2		2	1	1	6
	system-of	2	1		1	1	5
	affords	3		1	1	1	6

fied, 4.2; ..... entire, 5.5; and ..... affords, 6.7 fixations.

The manner in which both oral and silent readers read or attempted to read these seven characters indicates that they proved unusually difficult for a large proportion of the students in whose selections they occurred. When examined carefully, the characters show a wide diversity in form and construction. Collectively the characters contain five different elements; namely, consonant stems, breves, s-circles, an r-hook and a st-loop. The stems are differentiated by virtue of their length and shading into full-length, half-length, double-length, and light and heavy stems. The number of elements in the characters range from one to four and the positions in which the characters are written vary from first to fourth.

Rates of Reading Printed and Shorthand Material

The students were asked to read the printed selection over the dictaphone in their usual manner and rate of reading. Only two errors were made and each of these occurred in the reading of the first sentence. However, the time used by the different readers indicates that their rates of reading easy printed material vary widely. Table IX shows the range and median length of time used by each group in reading this selection.

TABLE IX

TIME USED IN ORAL READING OF PRINTED SELECTION

Group	Range of Reading Time (in Seconds)	Median Time (in Seconds)	Ratio of Slowest Reader's Rate to Fastest Readers' Rate (in Per Cent)
1	31.5 - 41.5	35.0	79.5
2	29.5 - 37.0	34.2	79.8
3	30.5 - 44.0	33.5	69.3
4	26.5 - 42.5	31.7	62.4
All	26.5 - 44.0	34.0	60.2

The figures in the last column of this table indicate that the slowest reader read only about three-fifths (60.2 per cent) as rapidly as the fastest one. The advanced students (Group 4) show the greatest and beginners who used vocalized shorthand material show the least divergence in their rates of reading print. In these groups the fastest readers read respectively, about three-fifths and four-fifths as fast as the slowest ones. The wide variations in the reading rates of the students as a whole appear to be mainly due to the fact that they were evening school students who differed considerably in age and previous schooling. Also the reading demanded by their day-time occupations was more limited in extent and nature than that ordinarily required of full-time students.

In Table X data representing the rates of reading of the shorthand material are presented. These rates also show extremely wide individual variations. The relative rates of reading of the groups cannot be determined since the various groups of students read different groups of selections and these may have not been equally difficult for the respective groups of readers.

The relation between the students' rates of reading printed material and of reading shorthand is indicated graphically in Figure 2. Marked positive agreement between the two factors is shown by the advanced students and by the beginners whose shorthand material was unvocalized; but within the other groups the elements are practically unrelated.

Representative Records of Oral Reading

In this section the records of three students who read different shorthand selections are presented to illustrate the specific nature of the oral reading. In these records the correct meaning of the material is expressed above the characters and below

TABLE X

RATES OF READING OF FOUR GROUPS OF STUDENTS IN THE ORAL READING OF FOUR GROUPS OF SHORTHAND SELECTIONS

Group 1		Group 2		Group 3		Group 4		
Subjects	Average Time per Character (In Seconds)	Subjects	Average Time per Character (In Seconds)	Subjects	Average Time per Character (In Seconds)	Subjects	Average Time per Character (In Seconds)	Total
1a	3.4	2a	2.1	3a	1.3	4a	1.8	
1b	1.6	2b	2.7	3b	5.5	4b	4.6	
1c	1.4	2c	1.9	3c	3.8	4c	2.3	
1d	4.3	2d	2.6	3d	1.9	4d	2.7	
1e	2.3	2e	3.9	3f	2.1	4e	1.6	
		2f	1.8			4f	1.8	
1f	4.6	2g	2.7	3g	1.7	4g	2.3	
1g	2.4							
1h	2.8							
1i	3.2							
1j	2.6							
Range	1.4-4.6		1.8-3.9		1.3-5.5		1.6-4.6	1.3-5.5
Median	2.75		2.58		2.0		2.12	2.42
P.E. of Med.	.25		.27		.55		.38	.26

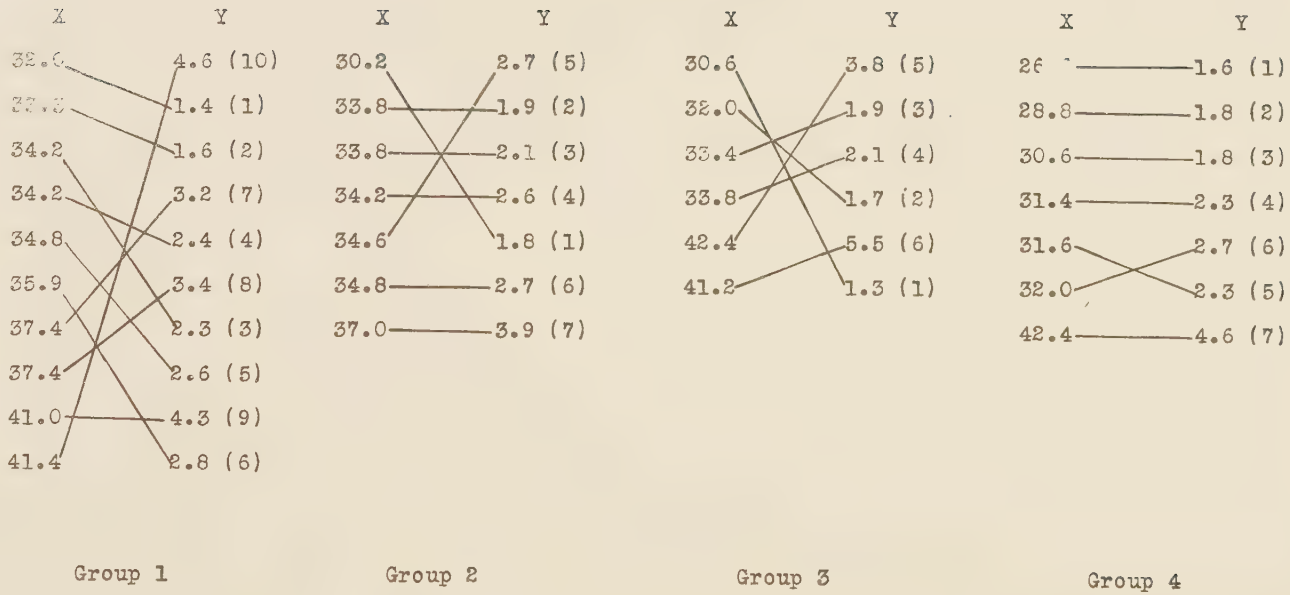


Figure 2. Graphic representation of the relation between the rates of reading printed material (X) and the rates of reading shorthand material (Y) for four groups of oral readers.

Note. The numbers in parentheses, as a whole, represent only the approximate order of the cases in their series, and not their true rank. However, the numbers are sufficiently accurate for their purpose.

them are the incorrect and self-corrected meanings given by the students. Notations of the omissions, repetitions, and aid given in reading appear beneath the proper characters.

Careful examination of Plate I, which is a record of Subject 1c in reading Selection Ic, shows that the reader made 18 errors in reading the five lines of the selection. Thirteen of the characters were misread without correction, two were misread then read correctly, and the meanings of three characters were once repeated. No characters were omitted or prompted.

Table XI furnishes a summary of the errors made in this reading. One-third of the total number of errors was due to misreading the four simple word-signs ..... the, ... a, ... could, and ..... kingdom. The fact that a few characters, such as ....., may have two or more meanings indicates that these characters cannot be interpreted by direct reading alone; they must be read also in light of the context. Lack of mastery of the four word-signs above noted is responsible for the reader's errors on them. This is evident in the fact that she twice misread ..... the, and ..... could, and gave a different meaning at each misreading. Her poor command of word-signs is further shown in her reading of both ..... a, and ..... they, as ..... the; however, she corrected the latter error.

The seven other characters which were misread without correction are ..... dispatch, ... ship, ... do-this, ... sail, ... to-Cuba, ... exciting, and ..... enjoy. In the silent reading of eight other subjects who read Selection Ic the average numbers of fixations for each of the five characters range from 3 to 5.2. Thus the errors made by Subject 1c in the oral reading of these characters are paralleled by the concentrated efforts of the students who read them silently. Explanation of the difficulty

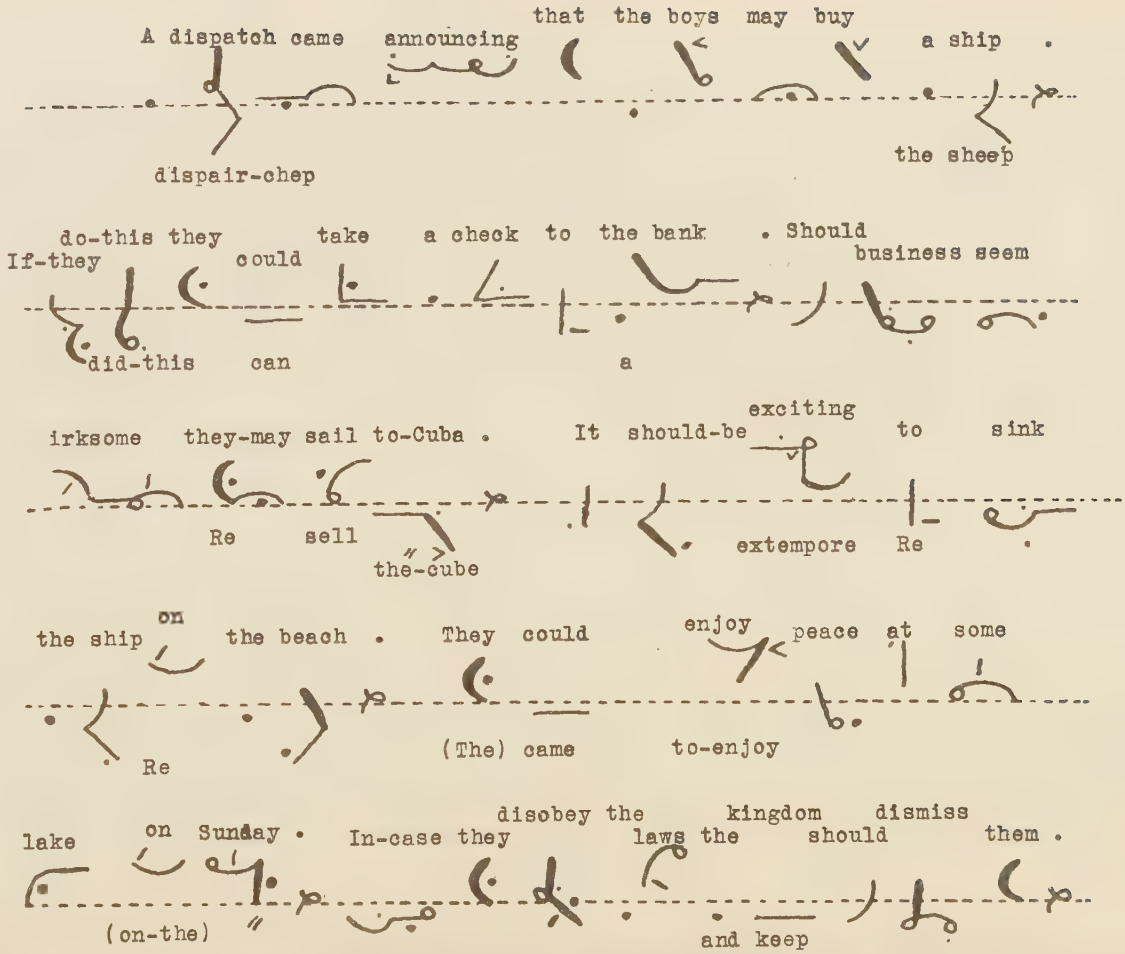


Plate I. Oral Reading of Selection Ic by Subject 1c. The meanings given above, by the reader are recorded beneath the characters. Re means that the

TABLE XI

SUMMARY OF ERRORS MADE BY STUDENT 1c IN
ORAL READING OF SELECTION Ic

Meaning of Characters Read Incorrectly	Meanings Given by Students	Characters Read Incorrectly	Characters Denoted by Students' Readings	Errors	
				Kind	Number
dispatch	dis-pair-chep			Uncorrected Misreading	1
the	a			Uncorrected Misreading	1
the	and			Uncorrected Misreading	1
ship	sheep			Uncorrected Misreading	1
do-this	did-this			Uncorrected Misreading	1
could	can			Uncorrected Misreading	1
could	came			Uncorrected Misreading	1
a	the			Uncorrected Misreading	1
sail	sell.			Uncorrected Misreading	1
to-Cuba	the-cube			Uncorrected Misreading	1
exciting	extempore			Uncorrected Misreading	1
enjoy	to-enjoy			Uncorrected Misreading	1
kingdom	keep			Uncorrected Misreading	1
they	the			Corrected Misreading	1
on	on-the			Corrected Misreading	1
they-may				Repetition	1
to (sink)				Repetition	1
on (the)				Repetition	1
Total					18

of these characters as indicated by an analysis of the errors of misreading is given in the following chapter.

On the whole the reading of this selection by Subject 1c was carelessly done. She misread nearly one-fourth of the characters without correction and corrected but two of the errors which she made. It is evident that she read the passage character by character and with a minimum of understanding of its meaning.

Plate II represents reading of a different type. The errors made by the reader, Subject 3f, consist of misreadings only. Four of these errors were corrected. Three word-signs were misread; but the errors on two of these, ... will and ..... should, were corrected by the reader. These are simple characters and each was read in an average number of 2.5 fixations by the sixteen students who read them silently. The manner in which they were misread orally indicates that the reader temporarily confused them with two other characters which are identical to them in shape, length, and shading, but different in position and alignment. The word-sign, ... circumstance, which was completely misread, is much less frequently used than are those above noted. Its usage and construction render it generally more difficult to the reader. This inference is supported by the fact the silent readers made an average number of 3.3 fixations in interpreting or attempting to interpret it.

The summary of the errors in Table XII shows that Subject 3f completely misread five other characters, namely ..... severe, ... roof, ... rafters, ... pulp, and ..... for-them. The average number of fixations made by 16 silent readers on ..... roof, ... rafters, and ..... pulp are 2.7, 9.1, and 5.7 respectively. The average length of their fixations is 12.4 units. Thus the last two characters appeared more than ordinarily difficult

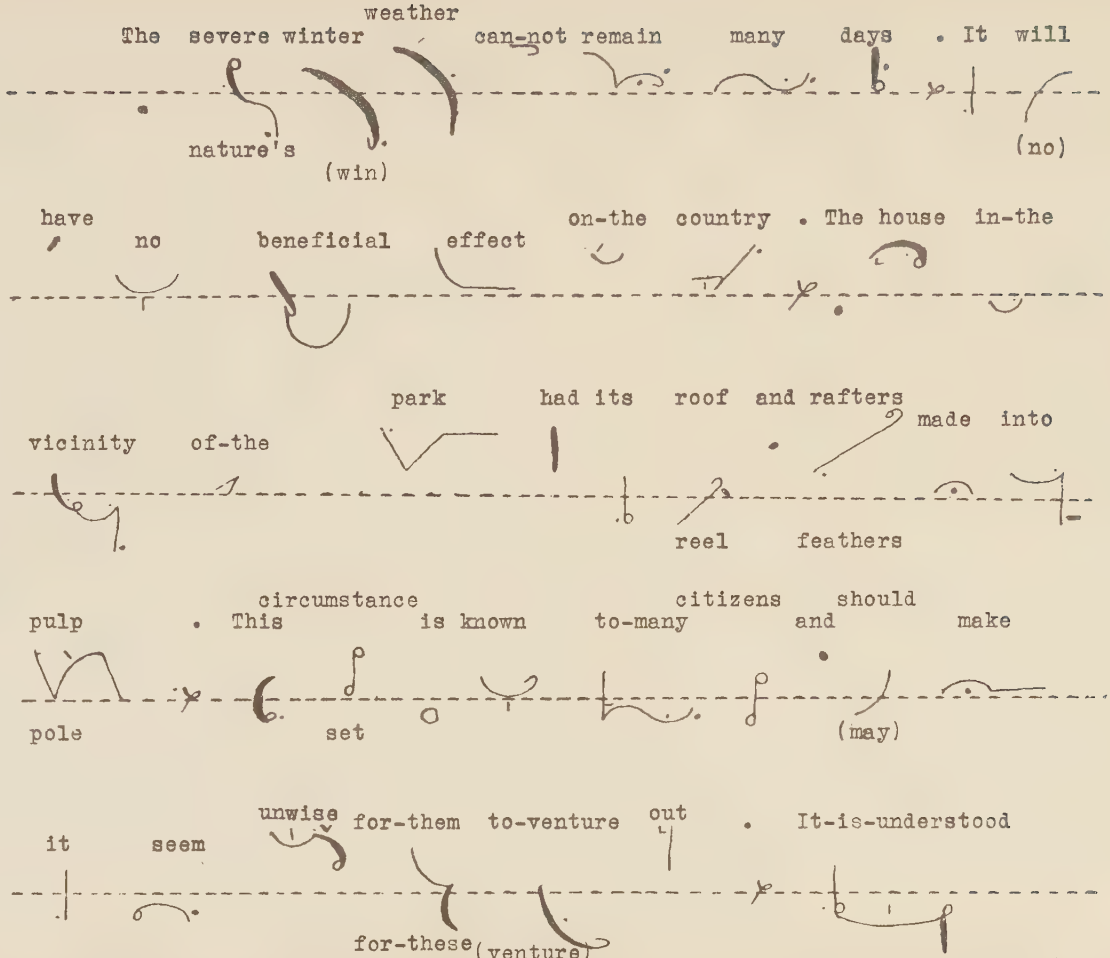


Plate II. Oral Reading of Selection IIIb by Subject 3f. The meanings given incorrectly by the reader are recorded beneath the characters. The corrected misreadings appear in parentheses.

TABLE XII

SUMMARY OF ERRORS MADE BY SUBJECTS 3f AND 4b IN READING SELECTIONS IIIb AND IVa RESPECTIVELY

Subject	Meaning of Characters Read Incorrectly	Meanings Given by Students	Characters Read Incorrectly	Characters Denoted by Students' Readings	Kinds and Numbers of Errors				
					Uncorrected Misreadings	Corrected Misreadings	Repetitions	Promptings	Total
3f	severe	nature's			✓				1
3f	roof	reel			✓				1
3f	rafters	feathers			✓				1
3f	pulp	pole			✓				1
3f	circum-stance	set			✓				1
3f	for-them	for-these			✓				1
3f	winter	win				✓			1
3f	will	no				✓			1
3f	should	may				✓			1
3f	to-venture	venture				✓			1
									10
4b	ought-to	at-the			✓				1
4b	assets	assorts			✓				1
4b	of	the			✓				1
4b	gradually	actually			✓				1
4b	with-you	with-your			✓				1
4b	whereby	representatives			✓				1
4b	observe	discern				✓			1
4b	your	we				✓			1
4b	with						✓		1
4b	and-your						✓		1
4b	we						✓		1
4b	you-could						✓		1
4b	protection							✓	1
4b	responsibility							✓	1
4b	provision							✓	1
									15

for a considerable number of silent readers.

In the reading of Subject 3f who read ..... rafters as ..... feathers, one cannot determine whether she recognized the stem r or confused it with the stem ..... f. However, it is more likely that she recognized it but before sounding it aloud proceeded to the f-hook which she apprehended; but, by mistaking the position of the character she read the hook as fe. Apparently she next added -ther in recognition of the double-length stem and finished by sounding s expressed by the s-circle inside the hook. It is very probable that this misreading is due, in a large measure, to the reader's failure to recognize and assemble the parts of the character precisely in the order which the rule requires. Her error is due also, in part, to the fact that the rule which applies in this case provides an exception to the general principle that the parts of characters are read directly in the order in which they are written. However, such exceptions are not uncommon in shorthand; and their mastery by the student is necessarily an important part of her training.

In the misreading of ..... pulp as ..... pole, Subject 3f omitted the final p stem and mistook the heavy dash vowel for the light one. The students' difficulties in reading this character probably depend on their inability to recognize upward l between parallel stems or to their hesitancy in identifying this stem in relation to the rules governing its usage.

In general, the reading of Subject 3f was orderly and painstaking, although it was marked by several inaccuracies. Her comprehension of the passage was fair, with the exception of the third sentence most of which she evidently misunderstood.

The reading of Subject 4b, Plate III, illustrates the tendency of many of the students to make a variety of errors. Table

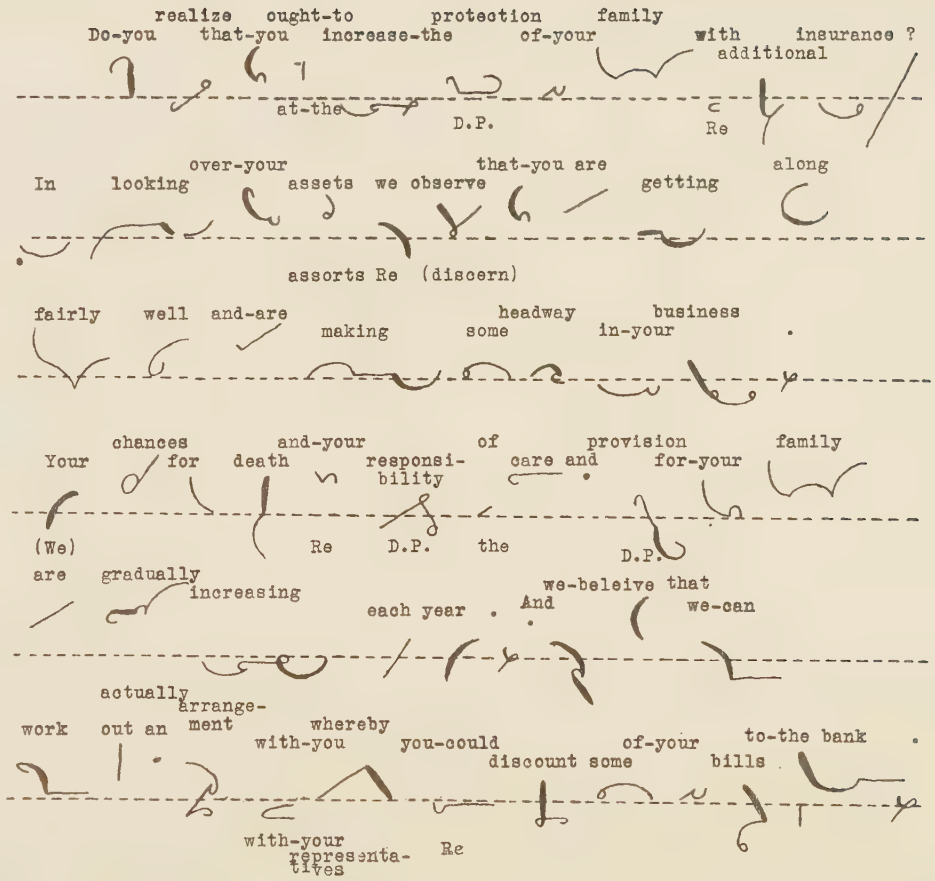


Plate III. Oral Reading of Selection IVa by Subject 4b. The meanings given incorrectly by the reader are recorded beneath the characters. The corrected misreadings appear in parentheses. Re denotes that the reader repeated the meaning and D.P. means that she delayed until prompted.

XII shows that this reader misread six characters without correction and two with correction, and that she repeated the meanings of three characters, and hesitated until prompted on three others. No single type of character seems to have been the main cause of her difficulties, since errors were made on four word-signs, four phrases and six other characters which consist of from one to four elements or parts.

Two phrases, and-your and you-could, the word-sign with, and the one-stem character we, were once repeated. These repetitions were made on the relatively simple characters which immediately precede more complex ones. Apparently the reader repeated the meaning of , , and as aids in her interpretation of, respectively, , , and . The repetition of we, was made after the student detected her mistake in misreading the following character, observe. She bridged over her error by repeating the previous character and then correctly reading the troublesome one. Thus the repetition in this case probably served as an aid in recovering the thought of the context.

The errors made by Subject 4b on protection, responsibility, and provision were due to extremely long delays which ended in the reader's being prompted with the correct meanings. In the silent reading of the last two of these characters 14 students made average numbers of 2.4 fixations and 3.5 fixations respectively. The average duration of the fixations was 9.3 units. From these readers responsibility received slightly less than the average amount of reading time, and provision required slightly more than average attention. The character is in the first line of the selection, hence the manner in which it was read silently is not considered here.

The fact that Subject 4b spent on each of these characters the average time of 27.4 seconds indicates that they were extremely puzzling to her. In these cases and in all others involving prompting the students made no audible interpretation of the characters; hence it is impossible to determine the nature of their difficulties.

The record of the reading of Subject 4b, above-discussed, typifies that done by a majority of the oral readers. They made four or five kinds of mistakes and spread them widely over the material. Neither the errors as a group nor those made by a single student are confined to a few forms of characters. The diversity in form and construction of the characters makes numerous and varied possibilities for error in reading. The records of the oral reading show that identical misinterpretations were made on but very few characters. The records of the silent reading indicate likewise that the manner in which characters were read or misread varies widely with the different readers.

Summary of Chapter

1. The kinds of errors which have the most serious effect on the oral reading of shorthand are the misreading of characters without correction, delays which necessitate promptings, and the omission of characters. The least serious kinds of errors are the corrected misreading and rereading of characters.

2. Nearly half of the errors made by thirty oral readers were uncorrected misreadings. They may be attributed to a variety of specific causes which are discussed in the next chapter.

3. Reading delays ending in promptings and the omission of characters represent respectively 19 per cent and 6.4 per cent of the total number of errors. These errors were due chiefly to the difficulty of the characters. Some of the omissions were probably caused by the readers' failure to notice the character.

4. The rereading of characters comprises nearly a fifth (18 per cent) of the total number of errors. The meanings of many simple characters were repeated while the reader was attempting to interpret the next character. Rereadings were made mainly in order to verify meanings previously given or to recall the thought of the context after delays in reading the following characters.

5. The corrected misreadings, representing about one-seventh of the entire number of errors, consist of either (a) slight mistakes which were detected and corrected immediately after they were made, or (b) serious errors which the reader found it necessary to correct before interpreting the following characters.

6. The members of each group of readers showed wide individual variations in their rates of reading both shorthand and easy printed material. In general the rate at which the students read the printed material bears no significant relation to their rate of reading shorthand.

7. The students in each group also differed widely in their capacity to read shorthand accurately. A few of the readers did excellent reading, as they made only one or two kinds and a very small number of errors. The majority of the readers, however, made four or five kinds and relatively large numbers of errors. The complexity of shorthand writing, which depends chiefly upon the variety of symbols that are used and the combinations in which they occur, gives a decidedly individualistic quality to the reading.

CHAPTER V

DETAILED ANALYSIS OF ERRORS OF MISREADING

Introduction

The misreadings which were not corrected constitute the largest and, by far, the most important group of errors which the students made in oral reading. These errors have been analyzed for the purpose of discovering, so far as possible, their nature and causes. The main step in the analysis was the direct comparison of the misread characters with those denoted by the incorrect meanings which the students gave in reading. For example, if the symbol ..|... meaning <u>to</u> were misread for ..|... meaning <u>to-the</u>, a comparison of the form and length of the two symbols may show plausible cause for the misreading.

A second, though much less productive, step was the attempt to determine whether an explanation for the misreading of certain characters may be found in an examination of the context in which the characters occur. In reading the shorthand equivalent of the following sentence, In case they disobey the laws the kingdom should dismiss them, three students misread ....., kingdom, as ....., king. The consideration of this type of error may disclose whether the context may be such that it predisposes the student to misreading.

The value of the direct comparison of characters reported in this chapter depends upon the assumption that the reader mistakes the character before her or certain of its parts for some other character or parts which she gives in the misreading. This assumption seems valid in the light of the marked similarity which exists between the misread characters on their parts and the cor-

responding characters or parts represented by the misreadings.

Because of the relatively slight differences in the length, position, shading, and alignment of many of the symbols in Munson shorthand, the confusion of similar elements in reading is thoroughly natural and, within certain limits, unavoidable. Indeed, the reader of shorthand written in another system, such as Gregg, is subject, likewise, to confusion since in this system there are varingly slight distinctions between related features of many of the characters or of their parts.

Types of Errors Defined

The comparison of the characters misread with those denoted by the incorrect meanings shows that the errors hitherto classified as uncorrected misreadings fall into six distinct subclasses or types. The types are:

1. Misreading the position of symbols, such as reading first position for second, or third position for first;
2. Misreading the shading of stems, such as reading a light stem for a heavy one, or vice versa;
3. Misreading the length of stems, such as reading a half-length for a full-length, or a full-length for a double-length;
4. Omitting parts of characters, such as misreading ..... office, as ..... off, by omitting the s-circle;
5. Addition of parts to characters, such as misreading ..... kingdom, as ....., keep, by adding ..... stem;
6. Confusion of symbols or of related parts of characters as in misreading ....., if, as ..... should, by confusing ..... and ..... stems, or in misreading ....., stayed, as ....., said, by confusing s-circle and st-loop.

The misreadings which the students may have made by virtue of the context are defined as follows:

1. Neglect of the context in reading symbols or characters which have two or more meanings, as in reading ....., as-to, for as-the. This error was made in reading the sentence which means, It is ideally situated as-the nation's shrine. Since the misread symbol may mean as-the, as-to, or as-it the reader must determine from the context which one of the three meanings should be used.
2. Probable misuse of the context as in reading ....., king, for ..... kingdom, such as in the sentence previously noted (p. 76). However, in this and all other instances of its kind the student's misuse of the context, if such were the case, cannot be held wholly responsible for the error. While a consideration of the context may predispose the student to misread, in the final analysis of the case her error must be attributed to her failure to read the character directly. In this study the nature and number of such misreadings could not be determined with a satisfactory degree of accuracy. Hence in reporting data which represent errors due to neglect or misuse of the context, no attempt has been made to include all errors which may have arisen from this cause. Instead, only those errors which seem clearly attributable to lack of attention to, or guessing from, the context have been tabulated as errors of this type.

Tabulation of Types of Errors

Tables XIII-XVIII, inclusive, show specifically the nature of the uncorrected misreading done by three groups of students. The errors made by the advanced students are very similar to those made

by the other students. However, this group read more selections and made a relatively greater number of errors than did any of the other groups. The misreadings of this group do not include any type of error which is not represented in the tables for the other groups. Hence, tables which show the specific errors of Group 4 are here omitted.

In the misreading of several of the characters two or more type errors were made. The writer has not attempted to record these errors in the tables in the exact order in which the reader made them. The students normally read the various parts of the characters in the order which correct reading requires. However, in most of the misreadings which include two or more specific errors one cannot reliably determine the order in which the reader interpreted or misinterpreted the different parts of the characters.

Two tables are used in reporting all of the type errors made by a given group. The first table shows the errors made in misreading the position, shading, and length of the symbols or parts of characters; the second presents those made by omitting and adding parts of characters and by confusing symbols and character forms. In order to note all of the errors made on some of the characters the two tables must be considered together. In cases in which different type errors for a certain character are recorded in both tables this fact is indicated by asterisks in the tables.

Results of Analysis of Misreadings

Table XIX shows the numbers of students who made the different types of errors and the numbers of errors which they made. The largest proportion of the errors was due to confusion of symbols or of the parts of characters. More than a fourth (26.4 per cent) of all of the specific errors in misreading are of this type.

TABLE XIII

SPECIFIC ERRORS DUE TO MISREADING OF POSITION, SHADING OR LENGTH OF SYMBOLS OR OF CHARACTERS IN THE READING OF SELECTIONS Ia, Ib, AND Ic BY GROUP 1

Characters Misread (Partly or Wholly)	Characters Denoted by Misreading	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		a	the	Read 3rd position for 2nd position
		could	can	Read 1st position for 3rd position
		should	shall	Read 1st position for 3rd position
		the	a	Read 2nd position for 3rd position
		do-this	did-this	Read 3rd position for 2nd position
		do-this	had-this	Read 1st position for 2nd position
		the	and	Read 1st position for 3rd position
		can	could	Read 3rd position for 1st position
		them	that	Read 1st position for 2nd position
		to-show	should	Read 3rd position for 4th position
		too-hasty	hasty	Read 2nd position for 4th position
		to-invoice	invoice	Read 1st position for 4th position
		could-not	can-not	Read 1st position for 3rd position
		if-the	if	Read stem for half-length of this stem
		voice	views	Read 3rd position for 1st position*
		induce	indouce	Read 3rd position for 1st position*
		hostess	most, mostess	Read light stem for heavy stem
		ship	sheep	Read heavy dot vowel for light dot vowel
		irksome	ōrksome	Read heavy dash vowel for light dash vowel
		irksome	awesome	Read 1st position stem and heavy vowel for 2nd position and light vowel*
		sail	sell	Read light vowel for heavy vowel
		they-said	they-did	Read half-length for full-length*
		to	to-the	Read half-length for full-length
		kingdom	can	Read 1st position for 3rd position
Total				

*See also Table XIV.

TABLE XIII (Continued)

Types and Numbers of Errors						Students Misreading
Position			Shading		Length	
Word-signs	One-stem Characters (Not Word-signs)	Characters With Two or More Stems	Stems (Not Word-signs)	Vowels	Half-Lengths	
13	.....	.....	.....	...	...	1c,1e,1f, 1g,1h,1i
4	.....	.....	.....	...	...	1e,1f,1g, 1i
4	.....	.....	.....	...	...	1e,1g
3	.....	.....	.....	...	...	1a,1b
3	.....	.....	.....	...	...	1a,1c,1g
1	.....	.....	.....	...	...	1j
1	.....	.....	.....	...	...	1c
1	.....	.....	.....	...	...	1b
1	.....	.....	.....	...	...	1i
...	1	.....	.....	...	...	1f
...	.....	6	.....	...	...	1a,1b,1c, 1d,1e,1i
...	.....	2	.....	...	...	1a,1h
...	3	.....	.....	...	...	1b,1c,1f
...	.....	.....	.....	...	1	1a
...	1	.....	.....	...		1a
...	.....	1	.....	...	...	1d
...	.....	.....	3	...	...	1c,1f,1h
...	.....	.....	.....	1	...	1c
...	.....	.....	.....	1	...	1d
...	.....	1	.....	1	...	1e
...	.....	.....	.....	7	...	1b,1c,1d, 1e,1f,1g,1i
...	.....	.....	.....	...	1	1e
...	.....	.....	.....	...	1	1f
1	.....	.....	.....	...	...	1i
32	5	10	3	10	3	10

TABLE XV

SPECIFIC ERRORS DUE TO MISREADING OF POSITION, SHADING, OR LENGTH OF SYMBOLS, OR OF CHARACTERS IN THE READING OF SELECTIONS IIa, IIb, AND IIc BY GROUP 2

Characters Misread (Partly or Wholly)	Characters Denoted by Misreadings	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		who	of	Read light, 2nd position breve for heavy 3rd position
		each	which	Read 2nd position for 3rd position stem
**		to-contain	to-have	Read 3rd position for 4th position stem*
**		to-contain	to-do	Read heavy stem for light stem*
**		to-contain	to-differ	Read heavy stem for light stem*
**		to-contain	to-dain	Read heavy stem for light stem
		life-of	eleva-tion	Read 2nd position for 1st position; f- stem for v- stem*
		different	tin	Read light stem for heavy stem*
		statue-of	large-of	Read heavy stem for light stem*
		seated	sitting	Read light, full-length stem for heavy, half-length*
		date	day	Read full-length stem for half-length
Total				

*See also Table XVI.

**In the phrase "to-contain," the prefix "con" is expressed by the proximity of this character to the one preceding it in the context. The fourth position in which the phrase is written made it difficult for the students to detect this proximity; hence the omission of "con" in reading the phrase was not tabulated as an error.

TABLE XV (Continued)

Types and Numbers of Errors						
	Position		Shading		Length	Students
Word-signs	One-stem Characters (Not Word-signs)	Characters With Two or More Stems	Stems (Not Word-signs)	Word-signs	Half-lengths	Misreading
1	.....	.....	.....	1	...	2a
..	1	.....	.....	..	...	2c
..	2	.....	.....	..	...	2c, 2d
..	.....	.....	1	..	...	2c
..	.....	.....	1	..	...	2e
..	.....	.....	1	..	...	2g
..	.....	1	1	..	...	2e
..	.....	.....	1	..	...	2c
..	.....	.....	1	..	...	2f
..	.....	.....	2	..	2	2b, 2e
..	.....	.....	.....	..	2	2b, 2d
1	3	1	8	1	4	7

TABLE XVI

SPECIFIC ERRORS DUE TO OMISSION OF ADDITION OF SYMBOLS, OR TO CONFUSION OF RELATED SYMBOLS AND FORMS OF CHARACTERS, IN THE READING OF SELECTIONS IIa, IIb, AND IIc BY GROUP 2

Characters Misread (Partly or Wholly)	Characters Denoted by Misreadings	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		to-his	his	Omitted t-stem
		it-is	it	Omitted s-circle
		Nation's	Nation	Omitted s-circle
		(it) commemorates	(it) memorates	Omitted prefix com (Proximity omission in writing)
**		to-contain	to-do	Omitted n- hook*
		statue-of	large-of	Omitted st- loop*
		seated	sitting	Added stem*
		he-was	hees-was	Added s-circle
		knowledge-and	intelligence-and	Added s-circle; confused and
		inside-a	instead-of-the	Added of- breve; confused with stem; confused a- breve with the- breve
		ideally	ideal	Confused upward and downward l's; omitted vowel after upward l
		honor	and-all	Confused with ; confused r- hook with and- breve
		after-a	after-the	Confused a- breve with the- breve
		man-and	man-who	Confused and- breve with who- breve word-sign
		a-man	the-man	Confused a- breve with the- breve
		it-is	he-is	Confused t- stem with he- breve
		date	is	Confused half-length stem with is- breve word-sign
		after-a	as-a	Confused double-length stem with as- breve word-sign
		some-of-the	some-of-these	Confused the- breve with stem
		life-of	elevation	Confused of- breve with shun-hook*
		said	stayed	Confused s-circle with st- loop
**		to-contain	to-have	Confused n- hook with v- hook*
**		to-contain	to-differ	Confused n- hook with v- hook*
		different	tin	Confused f- hook with n- hook*
		brought	bright	Absence of vowel led to guessing from context
		tall	tile	Absence of vowel led to guessing from context
		as-the	as-to	The same character with two (or more) meanings, thus necessitating guessing from context
Total				

*See also Table XV.

**See explanatory note following Table XV.

TABLE XVI (Continued)

Types and Numbers of Errors												Students Misreading
Omissions				Additions			Confusions					
Stems	S-circles	Vowels	Prefixes Hooks & Loops	Stems	S-circles	Breves	Stems	Breves	S-circles	Hooks	Context	
1	..	.	...	..	..	..	..	...	..	..	.	2c
..	1	.	...	..	..	..	..	...	..	..	.	2f
..	1	.	...	..	..	..	..	...	..	..	.	2e
..	..	.	1	..	..	..	..	...	..	..	.	2c
..	..	.	1	..	..	..	..	...	..	..	.	2c
..	..	.	1	..	..	..	..	...	..	..	.	2f
..	..	.	...	2	..	..	..	...	..	..	.	2b,2e
..	..	.	...	..	1	..	..	...	..	..	.	2g
..	..	.	...	..	1	..	..	...	..	..	.	2c
..	..	.	...	..	..	1	1	1	..	..	.	2e
..	..	2	...	..	..	..	2	....	..	..	.	2c,2f
..	..	.	...	..	..	..	1	...	..	1	.	2c
..	..	.	...	..	..	..	..	3	..	..	.	2b,2e, 2f
..	..	.	...	..	..	..	..	1	..	..	.	2e
..	..	.	...	..	..	..	..	1	..	..	.	2f
..	..	.	...	..	..	..	1	...	..	..	.	2a
..	..	.	...	..	..	..	2	...	..	..	.	2c,2g
..	..	.	...	..	..	..	1	...	..	..	.	2g
..	..	.	...	..	..	..	..	2	..	..	.	2c,2f
..	..	.	...	..	..	..	..	1	..	..	.	2e
..	..	.	...	..	..	..	..	...	1	..	.	2d
..	..	.	...	..	..	..	..	...	..	2	.	2c,2d
..	..	.	...	..	..	..	..	...	..	1	.	2e
..	..	.	...	..	..	..	..	...	..	1	.	2c
..	..	.	...	..	..	..	..	...	..	..	1	2c
..	..	.	...	..	..	..	..	...	..	..	2	2b,2g
..	..	.	...	..	..	..	..	...	..	..	1	2b
1	2	2	3	2	2	1	8	9	1	5	4	7

TABLE XVII

SPECIFIC ERRORS DUE TO MISREADING OF POSITION, SHADING, OR LENGTH OF SYMBOLS OR OR CHARACTERS, IN THE READING OF SELECTIONS IIIa, IIIb AND IIIc BY GROUP 3

Characters Misread (Partly or Wholly)	Characters Denoted by Misreadings	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		is	as	Read 3rd position for 1st position
		should	shall	Read 3rd position for 1st position
		a	the	Read 3rd position for 2nd position
		with	without	Read 1st position for 3rd position
		the	and	Read 1st position for 3rd position
		govern	begun	Read 3rd position for 2nd position*
		give the	come-and	Read 2nd position (light) for 3rd position (heavy)*
		at	it	Read 3rd position for 1st position
		to-venture	venture	Read 3rd position for 4th position
		knowledge	unusual	Read 2nd position, , for 1st position*
		known	none	Read 2nd position (heavy vowel) for 2nd position (light)
		ancients	ants	Read 1st position for 2nd position*
		sheep	shape	Read 2nd position for 3rd position
		sheep	ship	Read 3rd position (light vowel) for 3rd position (heavy)
		executor	execution	Read third position for 2nd position*
		making-the	making-en	Read 1st position for 2nd position
		you-asked	you-ask	Read full-length for half-length (adding d)
		to-the	to-do	Read full-length (heavy) for half-length (light)
		vote	foot	Read 3rd position (light) for 2nd position (heavy)
		for-them	for-that	Read half-length (3rd position) for full-length (2nd position)
		before-the	but-of	Read full-length for half-length
		before-the	above-the	Read full-length for half-length*
		slowly	solely	Read vowel before, instead of after, stem
		enemy	name	Read heavy vowel outside stem for light vowel inside stem*
		new	in-the	Read full-length for half-length
		may	made	Read half-length for full-length
		invasion	invader	Read double-length for full-length*
		invasion	invention	Read light vowel for heavy vowel*
Total				

*See also Table XVIII.

TABLE XVII (Continued)

Types and Numbers of Errors								Students
Position			Shading			Length		
Word-signs	One-stem Characters (Not Word-signs)	Characters With Two or More Stems	Word-signs	Stems	Vowels	Half	Double	Misreading
1	.....	.....	..	..	..	...	..	3a
1	.....	.....	..	..	..	..	..	3b
4	.....	.....	..	..	..	..	..	3a,3c,3e,3f
1	.....	.....	..	..	..	..	..	3c
1	.....	.....	..	..	..	..	..	3b
1	.....	.....	..	..	..	..	..	3f
1	.....	.....	1	..	..	..	..	3f
...	1	.....	..	..	..	..	..	3c
...	2	.....	..	..	..	..	..	3e,3f
...	.....	1	..	..	..	..	..	3a
...	.....	.....	..	..	1	..	..	3f
...	1	.....	..	..	..	..	..	3b
...	.....	1	..	..	..	..	..	3f
...	.....	.....	..	..	3	..	..	3c,3d,3e
...	.....	1	..	..	..	..	..	3f
...	.....	1	..	..	..	..	..	3b
...	.....	.....	..	..	..	1	..	3d
...	.....	.....	..	1	..	1	..	3a
...	1	.....	..	1	..	..	..	3f
...	.....	1	..	..	..	1	..	3e
...	.....	.....	..	..	..	1	..	3b
...	.....	.....	..	..	..	1	..	3f
...	.....	1	..	..	..	..	..	3d
...	.....	1	..	..	..	1	..	3b
...	.....	.....	..	..	..	1	..	3b
...	.....	.....	..	..	..	1	..	3b
...	.....	.....	..	..	...	..	1	3b
...	.....	.....	..	..	1	..	..	3a
10	5	7	1	2	5	8	1	6

TABLE XVIII

SPECIFIC ERRORS DUE TO OMISSION OR ADDITION OF SYMBOLS OR TO CONFUSION OF RELATED SYMBOLS AND FORMS OF CHARACTERS IN THE READING OF SELECTIONS IIIa, IIIb AND IIIc BY GROUP 3

Characters Misread (Partly or Wholly)	Characters Denoted by Misreadings	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		making-the	pending-the	Omitted ; confused and ; added n- hook
		nothing	something	Omitted stem; added s; confused and
		pulp	pole	Omitted final ; confused upward and downward l
		for-them	for-these	Confused with
		roof	chuf	Confused with
		series	seegures	Confused with ; added
		lately	later	Confused half-length and full-length l with double-length
		to-venture	to-figure	Confused with and ter- hook with r- hook; added stem
		you-said	yours-had	Omitted dot-vowel
		rafters	feathers	Omitted r- hook; confused double lengths of r and f
		circum-stance	set	Omitted s-circle; failed to recognize word-sign
		ancients	ants	Omitted shun-hook*
		slowly	surely	Confused and ; confused s-circle and r- hook
		laws	law	Omitted s-circle
		govern	gave	Omitted f- hook
		extensive	extinc-tive	Omitted s-circle; confused and
		evidence	events	Confused with n- hook
		give the	come-and	Confused the (a word-sign) with and- breve*
		invasion	invention	Added *
		invasion	invader	Confused shun- hook with double length*
		house	houses	Confused small and large s-circles
		rafters	reel	Confused ter- hook with n- hook; omitted s-circle
		we-acknowl-edge	you-acknowl-edge	Confused we- breve with you- breve

TABLE XVIII (Continued)

Types and Numbers of Errors											Students Misreading
Omissions				Additions			Confusions				
Stems	Vowels	Hooks	S-circles	Stems	Hooks	S-circles	Stems	Breves	S-circles	Hooks and Loops	
1	..	..	..	..	1	..	1	..	..	..	3f
1	..	..	..	..	..	1	1	..	..	..	3f
1	..	..	..	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	1	..	..	..	3b
..	..	..	..	1	..	..	1	..	..	..	3e
..	..	..	...	..	..	..	1	..	..	..	3c
..	..	..	..	1	..	..	1	..	..	1	3b
..	1	..	..	..	..	..	..	..	..	..	3c
..	..	1	..	..	..	..	1	..	..	..	3f
..	..	..	1	..	..	..	..	..	..	..	3f
..	..	1	..	..	..	..	..	..	..	..	3b
..	..	..	..	..	..	..	1	..	1	..	3a
..	..	..	1	..	..	..	..	..	..	..	3c
..	..	1	..	..	..	..	..	..	..	..	3a
..	..	..	1	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	..	1	..	..	3f
..	..	..	..	1	..	..	..	..	..	..	3a
..	..	..	..	..	..	..	..	..	..	1	3b
..	..	..	..	..	..	..	..	..	1	..	3b
..	..	..	1	..	..	..	..	..	..	1	3a
..	..	..	..	..	..	..	..	2	..	..	3b,3f

TABLE XVIII (Continued)

Characters Misread (Partly or Wholly)	Characters Denoted by Misreadings	Meaning of Misread Characters	Meaning Given by Students	Explanation of Errors
		receipt-of-your	receipt-from	Confused breves (of, your) with from- breve
		to-assist	to-resist	Confused with and st- loop with large circle*
		knowledge	unusual	Confused with *
		before-the	above-the	Confused f- hook with stem*
		they-were	very	Confused with ; misread
		they-were	they-are	Confused upward r with downward r
		evidently	eventu-ally	Confused and n- hook; confused upward and downward l's
		govern	begun	Confused f- hook with n- hook*
		roamed	remained	Added n- hook; omitted vowel
		executor	execution	Confused ter- hook with shun- hook*
		enemy	name	Omitted vowel*
Total				

*See also Table XVII.

TABLE XVIII (Continued)

Types and Numbers of Errors											Students Mis-reading
Omissions				Additions			Confusions				
Stems	Vowels	Hooks	S-circles	Stems	Hooks	S-circles	Stems	Breves	S-circles	Hooks and Loops	
..	..	..	..	..	..	..	..	1	..	..	3a
..	..	..	..	..	..	..	1	..	..	1	3e
..	..	..	..	..	..	..	1	..	..	..	3a
..	..	..	..	..	..	..	..	..	..	1	3f
..	..	..	..	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	1	..	..	..	3f
..	..	..	..	..	..	..	2	..	..	..	3f
..	..	..	..	..	..	..	...	..	..	1	3f
..	1	..	..	..	1	..	..	..	..	..	3a
..	..	..	..	..	..	..	..	..	..	1	3f
..	1	..	..	..	..	..	..	..	..	..	3b
3	3	3	4	3	2	1	18	4	2	7	5

TABLE XIX

NUMBERS OF ERRORS OF VARIOUS TYPES IN THE UNCORRECTED MISREADINGS OF THIRTY STUDENTS

Types of Errors	Students Misreading Without Correction		Classified Errors of Uncorrected Misreadings	
	Number	Per Cent of Total Number (30 Students)	Number	Per Cent of Total Number
Misreading position	26	86.7	111	25.1
Misreading shading	25	83.3	62	14.0
Misreading length	16	53.3	35	7.9
Omission of parts of characters	18	60.0	48	10.9
Addition of parts to characters	20	66.7	42	9.5
Confusion of symbols and character forms	24	80.0	115	26.0
Neglect of context	10	33.3	29	6.6
Unanalyzed misreadings	19	63.3	--	---
Total			442	100.0

Misreading the position of symbols represents the second largest group of errors. Slightly less than a fourth of this type of errors were due to failures to interpret the symbols exactly in accord with their positions. This error was committed by a greater proportion of the students (86.7 per cent) than was any other kind.

The number of mistakes made in recognizing the shading of consonant stems or vowel markings ranks third among the total numbers of specific errors. Such mistakes were made by more than four-fifths (83.3 per cent) of the students.

The omission of parts of the characters and the addition of parts to characters are responsible respectively for 10.9 per cent and 9.5 per cent of the uncorrected misreadings. The smallest groups of errors are those represented by inaccuracies in reading the length of character stems and failures to give necessary attention to the context. Figure 3 shows graphically the relation of the numbers of errors of various types to the total number of specific errors.

Primary Sources of Error in Reading

The specific errors revealed by the analysis of the misreadings have been classified on the basis of the construction and usage of the characters, or parts of characters on which the errors were made. Thus, in Table XIII the type errors which are attributed to the wrong interpretation of position are further classified as misreadings of position of (1) word-signs, (2) one-stem characters which are not word-signs, and (3) characters having two or more stems. Likewise the errors due to the faulty recognition of shading are classified as misreadings of shading of (1) stems which are not word-signs, and (2) vowel markings. It was thought that this procedure might help to answer the question,

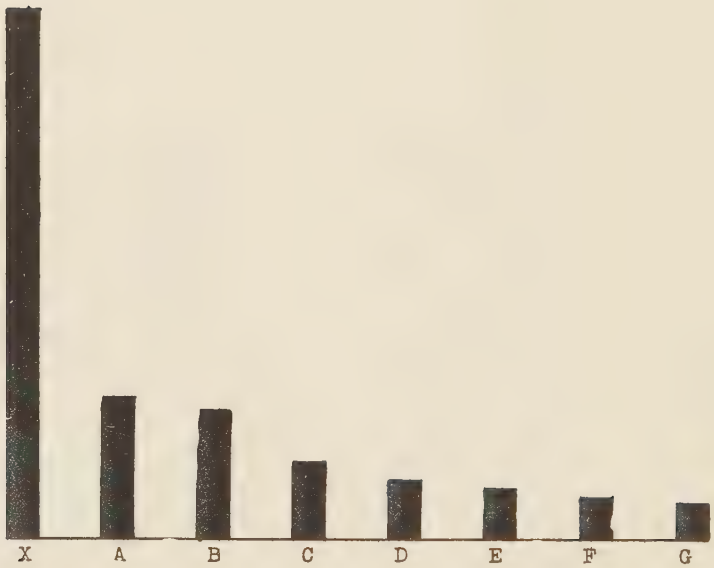


Figure 3. Graphical representation of the numbers of type errors in relation to the total numbers of such errors. The columns designate the following types of errors:

X, errors of all types
A, confusion of symbols or of parts of characters
B, misreading position
C, misreading shading
D, omission of parts of characters
E, addition of parts to characters
F, misreading length
G, neglect of context

What types of characters and which of their elements or parts are the sources of the greatest difficulty in reading?

Table XX shows how the type errors are distributed among a variety of forms of characters and parts of characters which differ in their construction and usage. The eleven forms listed in the table represent those most commonly used in the Munson system. The first three of these forms, as they are used in this study, represent complete characters; the next five may denote either characters or parts of characters; and the last three represent only parts of characters.

Examination of the table shows that the greatest variety and number of errors were made in reading full-length stems which are not word-signs. Approximately one-third of all of the specific errors were due to misreadings of these stems. Nearly three-fourths of the misreadings were caused by the confusion of related stems or misinterpretation of their shading. Confusions between curved stems occurred five times as often as did confusions between straight stems. The stems that were confused most frequently are downward and upward l. Heavy stems were confused slightly more often than were light stems.

Word-signs were the next greatest source of trouble. Misreading word-signs without correction is responsible for about one-seventh of the total number of type errors. Nearly all of the mistakes made on word-signs were due to reading their position incorrectly. Misinterpretation of shading and confusion with other characters are responsible for the other errors. Exactly one-half of the errors attributed to misreading the position of these symbols were made on the dot word-signs, ... and, ... a, and ..... the. The shading of four word-signs ....., ..., ..., and ..... was misread.

TABLE XX

TYPES AND NUMBERS OF ERRORS MADE ON DIFFERENT CHARACTER FORMS IN THE UNCORRECTED MISREADINGS OF THIRTY ORAL READERS

Character Forms	Types and Numbers of Errors						Total	Per Cent of Total
	Position	Shading	Length	Omissions	Additions	Confusions		
Word-signs	54	6				3	63	15.2
One-stem characters (not word-signs)	28						28	6.8
Characters having two or more stems	29						29	7.0
Full-length stems (not word-signs)		41	6	15	21	51	134	32.4
Half-length stems			26			4	30	7.3
Double-length stems			3			4	7	1.7
Breves (other than breve word-signs)				1	3	24	28	6.8
S-circles (small and large)				14	8	10	32	7.7
Vowel markings		15		5		2	22	5.4
Hooks and loops				11	9	17	37	9.0
Prefixes and apostrophes				2	1		3	0.7
Total	111	62	35	48	42	115	413	100.0

Hooks and loops are responsible for the third largest proportion of the total number of errors. However, less than a tenth of the errors were made on these symbols. The four hooks which were most often confused are the l-hook, r-hook, f-hook, and n-hook. These were variously mistaken for each other and for stems and breves. Only one loop, the st-loop, was confused. In 11 instances hooks were omitted by the students and in nine cases they were added.

The misreading of s-circles ranks fourth among the numbers of errors made on the different character forms. About 8 per cent of all of these errors were due to this cause. The students omitted the small circle more frequently than they confused it with the large circle or with other symbols. It is probable that most of the omissions were due to the fact that the student's misinterpretation of the character precluded the use of the s-sound in its proper connection; hence they omitted it. The small circle was confused with the large circle more often than with any other symbol.

The numbers of errors represented by the misreadings of the other character forms are so small that they are of slight significance as indications of the sources of error. It should be noted here that the numbers of errors reported for the four character forms above stated do not necessarily show the relative importance of these forms as the primary sources of the specific errors. The numbers of times which these forms occur in the materials used by the different groups are by no means uniform. Also, the number of students used in this part of the study is entirely too small to justify final conclusions relative to the comparative difficulty of the symbols and types of characters here discussed. However, these data do show that thirty students ex-

perienced their greatest difficulty in interpreting the full-length consonant stems used in the study. They had appreciably less trouble with the word-signs and still less with hooks, loops, and s-circles. In their interpretation of seven other symbols and forms of characters they made perceptibly smaller numbers of errors. These seven forms, stated in order of their importance as sources of error, are: half-length stems, characters of two or more stems (not word-signs); one-stem characters (not word-signs), breves (not word-signs), vowel markings, double-length stems, and prefixes and apostrophes.

The Context as a Factor in Misreading

The extent to which the neglect and misuse of the context may influence students to misread may be seen from an examination of Tables XXI and XXII. Table XXI shows that six students in Group 4 misread 13 characters by either failing to give due consideration to the context or by interpreting the characters in light of the incorrect meaning which they gave to some part of the adjoining context. The fact that the characters listed in the table may be correctly read with two meanings makes it necessary for the students to depend on the context in reading them. When accompanied by vowel markings, however, these characters may usually be distinguished directly and without reference to the context. Since they are written without vowels in the selections, all students who ignored the context or misinterpreted it misread the characters, unless they guessed their correct meanings.

Table XXII presents the characters which were misread so strangely that their interpretations appear to be due largely or wholly to guessing from the context. In some of these cases the reader apparently looked ahead for a suggestion on the meaning of the troublesome character. For example, a student read "The severe winter weather" as "Nature's winter weather." Evidently she did

TABLE XXI

UNCORRECTED MISREADINGS ATTRIBUTED TO INSUFFICIENT ATTENTION TO AND MISINTERPRETATION OF THE CONTEXT, BY GROUP 4, IN READING FOUR SHORTHAND SELECTIONS

Characters Misread	Characters Denoted by Misreadings	Context Meaning of Misread Characters	Meanings Given by Students	Explanation of Errors	No. of Errors	Students Misreading
		an	and	Lack of attention to meaning of following context	1	4g
		with-you	with-your	Lack of attention to meaning of following context	1	4b
		not	on-the	Lack of attention to meaning of following context	2	4b, 4f
		mass	times	Lack of attention to meaning of following context	4	4a, 4e, 4f, 4g
		there-has	there-is	Lack of attention to meaning of following context	2	4b, 4f
		I-am	of-my	Lack of attention to meaning of following context	1	4a
		which	change	Lack of attention to previous and following context	1	4b
		insurance	news	In absence of vowels, failed to follow context closely	1	4f
		assets	assats	In absence of vowels, failed to follow context closely	1	4e
		fellow	fail	Read "fail" to agree with a misreading in previous context	1	4e
		up	hope	Read "hope" to agree with a misreading in previous context	1	4g
		increase-the	increased-the	Read "increased-the" to agree with misreading in previous context	1	4b
		entire	another	Misread following context; hence did not recognize the error of reading "the-entire" for "another"	1	4b
Total					18	6

TABLE XXII

UNCORRECTED ERRORS OF MISREADING ATTRIBUTED TO GUESSING FROM THE CONTEXT IN THE ORAL READING OF THIRTY STUDENTS

Characters Misread	Characters Denoted by Misreadings	Meaning of Characters Misread	Meanings Given by Students	Number of Misreadings	Students Mis-reading
		dishonest	this-message	1	1b
		too-hasty	distressed	1	1b
		customhouse	hostesshouse	1	1i
		customhouse	some-months	1	1c
		to-remind	to-admire	1	2c
		to-admire-the	to-memory-the	1	2d
		executed	exsculptured	1	2c
		severe	nature's	1	3a
		not accident	notwithstanding	1	4e
		service	success	1	4a
		work	business	1	4a
		United States	state	1	4a
				12	8

not know the meaning of severe. Apparently after reading winter weather, she discovered that "nature's" bears a meaningful relation to these two words. Hence she omitted the, and read in the manner indicated. Another student read "It was executed by a famous sculptor" as "It was exculptured by a famous sculptor."

In other cases, the impression from a character already read seems to have decided the meaning given to a character which the student could not read directly. Thus, in the clause, "Should they deceive the hostess at the customhouse," the character customhouse was read as hostesshouse. Apparently in a similar manner service was misread for success and work for business.

The illustrations above-noted indicate that the context must be used occasionally in reading shorthand and that too much dependence on it results in error. So far as it is possible to ascertain from the uncorrected misreadings, the students' neglect of the context caused a greater number of errors than did their misuse of it.

Summary of Chapter

In the discussion of this chapter seven specific types of error in shorthand reading have been recognized. As determined by an analysis of the misreadings of 30 students, these errors stand in the following order of importance.

1. Confusion of symbols and related character forms
2. Misreading the position of symbols
3. Misreading the shading of consonant stems
4. Omission of the parts of characters
5. Addition of parts to characters
6. Misreading the length of stems
7. Neglecting to use the context

The analysis further shows that these errors were made upon a wide variety of character forms. Five types of errors were made in reading full-length stems which are not word-signs. These stems were the most common source of misreading. Word-signs stand next in per cent of total errors; three types of errors were made on these characters. Hooks and loops proved to be the third greatest source of error and s-circles rank fourth in this respect. Seven other forms of characters were responsible for smaller proportions of the uncorrected errors of misreading.

The great variety in the structure and usage of shorthand symbols imposes peculiar demands upon the reader. It is not at all surprising that students in attempting to meet these demands make discouragingly large numbers of errors. An analysis of the reading of relatively simple characters shows that frequently the reader must give attention, almost simultaneously, to three or more elements, such as the shape, position, length, shading, and vowel markings, if present. The various ways in which ..... check, for example, may be misinterpreted will illustrate the errors which may result from inadvertence or faulty perception of one or more of these elements. If the reader mistakes the light dot vowel for a light dash vowel she may read the character as ..... chuck. If she also mistakes the light k stem ..... for the heavy g stem ....., she may read the character as ..... chug. If she mistakes the position of the character and interprets it in third position rather than in second, she may read it as ..... chick. If she mistakes the full-length stem ..... for its half length ..... and the light stem ..... for the heavy stem ..... and reads the character in first position instead of second, she may interpret it as ..... jacket. By variously misconstruing two or more elements in the character she may again misread it as joke, jug, or choke.

Correct reading often demands, also, careful discrimination between related forms of stems, such as ..\... and ..\... which, while alike in position, shading, and length, are entirely different stems and hence are interpreted differently. The analysis of errors shows that the students misread many stems by confusing them with others similar to them.

Still further complications in reading are presented by the more complex characters which contain modified forms such as circles, hooks, loops and curls. Each of these has its own peculiar meaning and requires interpretation in light of the other parts of the character to which it belongs.

It may be concluded from this discussion that shorthand reading is not a routine performance which can be carried on in a half perfunctory manner. Instead it represents a moderately high plane of mental activity. Indeed the effective interpretation of shorthand is not reading in the usual sense of the term. It is essentially a rational process which demands accurate perception and more or less detailed analysis of many of the characters. It requires prompt recognition of symbols by virtue of their physical properties such as length, position, and shading. In case of the longer characters it frequently demands an assembling of the meaning of the parts of the character in their proper relation. In addition, it occasionally requires a verification of the meaning of one or more characters previously read.

CHAPTER VI

EYE MOVEMENTS MADE IN SILENT READING AND THEIR INTERPRETATION

The discussion, in the previous chapters, has dealt mainly with the oral reading of shorthand in which four groups of evening-school students served as subjects. In the present chapter and two following ones the results obtained from the silent reading of five other groups will be presented. These groups read before the camera the same selections of shorthand and printed material which the other subjects read before the dictaphone. The silent readers composed four groups of regular high-school students and a group of competent stenographers.

Training of Subjects

In shorthand training the students who read silently closely resemble the oral readers, that is, they include beginning, intermediate, and advanced students. Groups A and B of silent readers consisted of lower juniors who had had about three months of shorthand training. Group C was composed mainly of upper juniors who had studied shorthand for approximately eight months. Group D consisted of lower seniors who had had about 13 months, or nearly three semesters, of shorthand study.

Groups A and B used different methods of instruction. Before and during the experiment the members of Group A followed the indirect or more commonly used method of learning shorthand. They used varied text and reference materials which are well adapted for use with this method. Van Sant's Manual of Shorthand, and Stephens and Knaus' Munson Shorthand were the main texts used.

The members of Group B used, before and throughout the experiment, the direct method of learning. Likewise, their study materials were appropriate for this method of instruction; McCredie's Primer of Shorthand, with Van Sant's Manual as a reference book, and Moser's Dictation Studies were mainly used by this group.

The members of Group C and D had been trained by a combination of the indirect and direct methods. During the experiment they continued to use the combined method; accordingly, they studied a variety of materials suitable for this mode of instruction.

Group E consisted of six young women who were well trained in shorthand. Four members of this group are graduates of the Moser Business College. They were recommended by Mr. Moser on their splendid records as students in his school. Each of the graduates had had approximately a year of experience as stenographer in a business office. The other two members of Group E also had been thoroughly trained in shorthand. In addition they had had about six years of experience in stenographic work. At the time of the experiment these two ladies were doing secretarial and stenographic work in offices at the University of Chicago. In general, the members of Group E may be regarded as mature students of shorthand and proficient stenographers; thus they appear well prepared to serve as expert subjects in this study.

The plan which was followed in photographing the eye movements of the silent readers has already been explained in Chapter II. Table XXIII summarizes the training of the silent readers and indicates what materials they used at the different readings.

TABLE XXIII

SUMMARY OF TRAINING OF SUBJECTS AND OF MATERIALS USED IN SILENT READING

Subjects		Median Academic Standing		Shorthand Study		Selection Read			
Group Notation	Number	At Beginning of Experiment	At End of Experiment	Methods Used	Status of Subjects at Beginning of Experiment	First Reading	Second Reading	Third Reading	Total
A	11	3B*	3A	Indirect	Beginners	Sel.I-a	Sel.I-b	Sel.V Sel.I-c	4
B	9	3B	3A	Direct	Beginners	Sel.II-a	Sel.II-b	Sel.V Sel.II-c	4
C	16	3A	4B	Combination of Direct and Indirect	Intermediate	Sel.III-a	Sel.III-b	Sel.V Sel.III-c	4
D	13	4B	4A	Combined	Advanced	Sel.IV-a	Sel.IV-b	Sel.V Sel.IV-c Sel.IV-d	5
E	6	Graduates of a high school and a business college		Combined	Expert	Sel.I-a-II-c Sel.V Sels.III-a IV-d			14

*3B, 3A, etc. denote respectively lower juniors, upper juniors, etc., in high school.

Factors Related to Shorthand Reading

A brief survey of three factors which appear to be significantly related to the students' performance in shorthand reading will be next reported. The factors are intelligence, accomplishment in class work in shorthand, and normal rate of silent reading. Obviously the specific effects of these elements cannot be traced in the records of the shorthand reading; yet a consideration of the factors aids in the explanation of many of the variations and peculiarities of reading.

Intelligence ratings were obtained from the Otis Group Intelligence Scale - Advanced Examination, which test was administered and scored by the writer. The grades which the students received in shorthand for the two semesters covered by the experiment were secured from their teachers. These grades serve as general measures of achievement in this subject. The eye-movement records of the silent reading of Selection V provide measures of the normal rate of reading of the subjects. Table XXIV presents the data from these three sources. The group data are arranged in downward order for Groups A, B, C, and D respectively.

The table shows that the groups vary slightly in median intelligence scores; the median for the group ranking highest exceeds the median for the lowest group by an equivalent in mental age of 8.4 months. However, within the groups very wide individual variations appear. In Group B which varies most widely, the difference between the highest and lowest scores represents a mental age difference of 4.1 years; and in Group D which shows the least variation, the difference is equivalent to 3.8 years in mental age.

Group D, or the advanced students, and Group B, or the beginners using the direct method, made virtually the same median grades in shorthand. The intermediate students rank next and the beginners using the indirect method are lowest in this respect.

TABLE XXIV

MEASURES OF INTELLIGENCE, ACCOMPLISHMENT IN SHORTHAND STUDY, AND ABILITY IN SILENT READING FOR FOUR GROUPS OF STUDENTS

Subject	Intelligence Scores (Otis Adv.Exam)	Shorthand Marks (Average for Two Semesters	Silent Reading of Printed Material			
			Fixation Pauses		Number of Regressive Movements	Reading Time per Line
			Aver.No. per Line	Average Duration		
4A	200	96	3.4	5.2	0.2	17.7
5A	169	89	8.3	5.2	0.8	43.2
2A	165	96	6.4	5.2	1.0	33.3
11A	165	89	7.0	7.5	0.8	52.5
6A	157	77.5	9.9	6.0	1.3	59.4
1A	147	77.5	6.9	5.6	1.5	38.6
3A	147	81	5.3	5.0	0.6	26.5
7A	146	81	5.3	5.6	0.5	29.7
8A	143	85	5.9	6.9	0.5	40.7
10A	141	81	5.2	7.7	0.8	40.0
9A	137	81	7.7	5.6	1.7	43.1
Median	149.2	82.6	6.4	5.7	0.9	39.7
5B	188	89	6.8	6.2	1.3	42.2
6B	187	88.5	5.7	5.1	0.5	29.1
4B	162	88.5	5.5	7.6	0.6	41.8
2B	156	89	7.7	7.5	1.1	57.7
9B	155	92.5	7.4	6.8	1.9	50.3
1B	147	85	6.8	6.4	1.6	43.5
7B	143	77.5	5.8	6.2	0.6	36.0
8B	135	89	7.0	5.7	0.6	39.9
3B	113	89	7.4	4.9	0.8	36.3
Median	156.2	89.4	6.9	6.2	0.9	41.2
14C	180	89	9.1	7.0	1.9	63.7
15C	178	92.5	7.9	4.7	2.0	37.1
13C	173	77.5	4.6	5.5	0.6	25.3
6C	172	81	5.6	6.1	0.4	34.2
2C	161	85	7.0	5.8	1.5	40.6
10C	161	81	6.8	6.3	0.8	42.8
4C	148	92.5	8.8	6.5	0.7	57.2
1C	143	85	2.7	6.0	0.5	16.2
5C	143	85	6.4	7.6	1.1	48.6
8C	143	89	4.4	6.9	0.4	30.4
12C	142	85	8.9	6.9	1.7	61.4
11C	139	81	7.1	5.5	1.3	39.0
7C	134	85	6.4	5.4	1.2	34.6
3C	129	85	6.3	5.5	0.4	34.6
16C	126	81	8.7	5.7	1.9	49.6
9C	117	81	8.8	6.8	1.6	59.8
Median	143.7	84.0	6.9	6.2	1.2	40.5
5D	173	96	7.8	8.3	1.3	64.7
11D	166	81	7.3	5.6	1.5	40.9
6D	165	96	6.2	5.5	0.5	34.1
2D	162	96	5.1	4.7	0.4	24.0
10D	160	81	5.1	6.9	0.7	35.2
9D	153	81	8.7	6.1	1.6	53.1

TABLE XXIV (Continued)

Subject	Intelligence Scores (Otis Adv. Exam)	Shorthand Marks (Average for Two Semesters)	Silent Reading of Printed Material			
			Fixation Pauses		Number of Regressive Movements	Reading Time per Line
			Aver.No. per Line	Average Duration		
1D	148	92.5	6.3	5.8	1.1	36.5
12D	137	89	6.6	8.2	0.9	54.1
4D	136	89	5.5	4.4	0.9	24.2
8D	135	89	7.0	8.9	1.3	62.3
7D	130	81	5.5	6.0	1.0	33.0
3D	128	81	5.7	4.9	1.1	27.9
13D	112	88.5	6.5	7.3	0.6	47.4
Median	147.5	89.5	6.4	6.1	1.1	37.5

The range of individual differences in grades is practically the same for all groups.

In the number of pauses per line made in the silent reading of easy printed material, the groups approximate each other closely. The median number of pauses made by Groups A and D, 6.4 per line, is somewhat less than the number, 6.9 per line, made by the other groups. Also the median duration of the pauses of the various groups is very nearly the same. The beginners made perceptibly fewer backward movements than did the other students. The median reading time per line required by the groups varies slightly. It is least for the advanced students, next in duration for the beginners who read indirectly, and greatest for the other beginners and intermediate students.

The reading time per line is the product of the average number of pauses per line and the average duration of the pauses measured in terms of a standard unit of one twenty-fifth of a second. This product is, in reality, the total fixation time used in reading the line. However, as the interfixation time represents but a small fraction of the time used in reading, the product above noted may be safely regarded as the reading time (17, p. 10). It is a reliable measure of the rate of reading and facilitates group comparisons in this respect.

The individual variations are relatively greater in the rate of reading than in the intelligence ratings or shorthand marks. The two groups of beginners show the widest and least extremes in speed. The faster readers in Groups A and B read about four times as fast and twice as fact, respectively, as did the slowest ones.

This survey reveals that in general the silent readers vary perceptibly in intelligence, rate of reading print silently, and in previous accomplishment in shorthand. However, the group

variations in each of these respects do not appear to be sufficiently large and uniform to have appreciably affected group performance in reading. In the remainder of this chapter the most important facts revealed by the shorthand reading of these students will be presented. A comparative evaluation of the group performance of these readers will be made in the following chapter.

Fixation Pauses in Shorthand Reading

The shorthand selections used in the study vary slightly in the length of the lines of writing. The lines in the material used with the beginning students are approximately 90 mm. long, while those read by the other students average 100 mm. in length. The greater length and complexity of the characters used in the selections read by the intermediate and advanced students account for the greater length of the lines. However, the selections read by the various groups contain approximately the same average numbers of characters per line. These numbers for the different groups of selections are: Group I, 11.2; Group II, 11.8; Group III, 11.5; and Group IV, 11.9. In this connection the characters in all first lines and incomplete lines were not counted, since the eye movements made in reading them are not included in the data of the study. In general, the full lines of selections are sufficiently uniform in length to warrant their use as units in considering the eye movements made in reading.

Table XXV presents the numbers of fixation pauses made by the groups in reading their respective series of selections. The average numbers of pauses per line are arranged in ascending order for the students of each group. In the columns following these numbers are the average deviations of the total pauses on the various lines from the mean number of pauses per line. These values, designated A.D.in the table, were obtained by dividing the sum of the deviations for all lines by the total number of lines in the

TABLE XXV

FIXATION PAUSES MADE BY GROUPS A, B, C, AND D IN READING FOUR GROUPS OF SELECTIONS

Group A, Three Selections			Group B, Three Selections			Group C, Three Selections			Group D, Four Selections		
Subjects	Pauses Per Line		Subjects	Pauses Per Line		Subjects	Pauses Per Line		Subjects	Pauses Per Line	
	Average No.	A.D.		Average No.	A.D.		Average No.	A.D.		Average No.	A.D.
1A	17.9	6.6	3B	18.2	3.7	1C	24.2	4.4	2D	20.8	5.0
4A	24.4	3.2	4B	20.4	5.0	4C	24.4	4.6	3D	22.4	5.7
3A	28.1	9.6	6B	24.0	7.7	8C	25.6	7.9	8D	23.0	5.6
9A	31.6	6.0	1B	24.2	14.8	3C	27.6	4.4	6D	26.8	8.1
5A	32.4	9.3	2B	26.1	4.1	2C	28.2	7.0	13D	28.2	11.0
6A	33.2	14.0	7B	26.7	11.9	6B	29.0	7.0	1D	30.5	11.3
11A	33.9	6.1	8B	31.7	8.6	7C	32.6	6.8	10D	31.6	8.3
10A	34.5	11.4	9B	35.9	8.7	5C	33.0	10.2	4D	31.6	15.9
2A	37.3	13.3	5B	37.2	19.1	13C	34.2	12.0	9D	34.6	9.7
7A	37.6	8.1				9C	34.8	12.8	12D	36.7	17.1
8A	38.2	11.8				12C	39.9	10.9	5D	37.0	14.6
						10C	40.6	7.2	7D	44.6	19.1
						11C	43.2	9.8	11D	75.0	42.3
						14C	52.7	19.7			
						15C	59.2	14.0			
						16C	61.0	24.0			
Median	33.2	9.0		26.2	8.5		34.0	8.0		31.2	10.5

Note: The median number of fixation pauses per line for all students is 31.9.

selections read.

A glance at the table reveals that very large numbers of fixations were required by the readers. The magnitude of these numbers leads one to suspect that either the material was far beyond the ability of the students to comprehend it or that the reading proceeded in a manner quite unlike that exemplified in the reading of ordinary print. The first suspicion is opposed by the fact that the students' responses to the questions following the photographing showed satisfactory comprehension of the material in all but five of the 160 student readings. Also in content and general difficulty the reading matter was not essentially unlike the material which the students used daily. The second suspicion is strongly supported by evidence, in the photographic records, of much more varied shifts of attention, of shorter perception spans, and of much longer pauses than are demanded in usual forms of silent reading.

The following record, Plate IV, of the reading of an intermediate student, which is typical of the shorthand reading as a whole, provides a good illustration of the frequent redirection of attention and recurrence of perception necessary in reading shorthand. This subject made an average number of 33.8 fixations per line in reading the selection. Since the median number of fixations of all students on all selections is 31.9 per line, the reader falls slightly below the norm in this respect. Close examination of her record shows that she made, on the average, 2.4 fixations per character and that slightly more than a fourth of her fixations were regressive. As approximately one-third of all fixations of the students were regressive the reader is above average in this respect. The average duration of her fixations is 14.4 units which is in excess of the median duration of the fixations, 11.4 units, for all students.

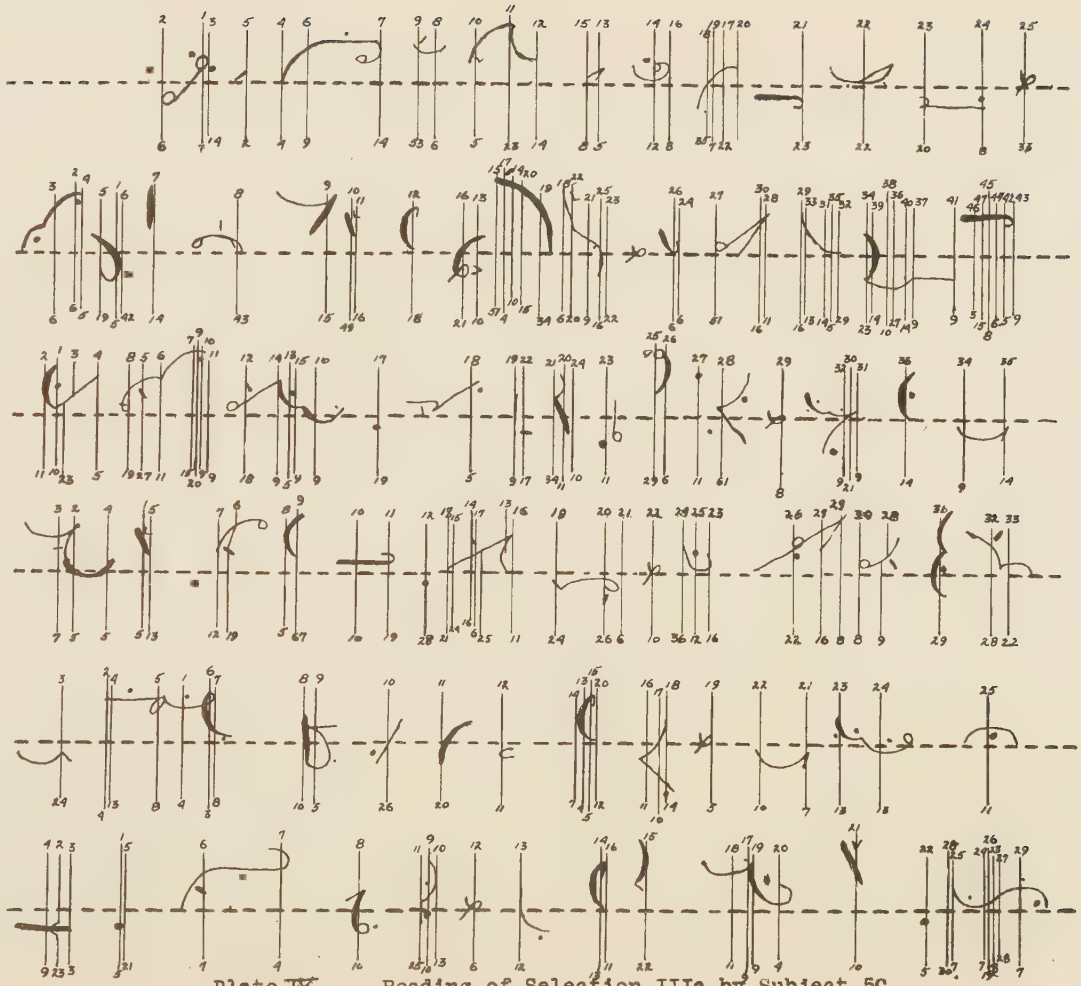


Plate IV. Reading of Selection IIIc by Subject 5C.

Further study of Plate IV shows that generally one or more fixations were required for each symbol in the writing. For example, on the second line of the selection, which contains 41 symbols, 47 fixations were made. Each of the 16 characters in the line received at least one forward fixation, excepting ..6.., denoting a period and signifying merely the end of the sentence. Four of the characters were read in a single fixation on each, but the others required an average of four fixations per character. These eleven characters contain 34 symbols or an average of three per character. The fifth line required the smallest number of eye movements. The average number of fixations made on this line is 2.1 per character of .8 per symbol. On the entire selection, which contains 189 symbols, 169 fixations were made or .9 fixation per symbol.

The records of the reading show that in many instances several fixations were made on a single symbol. In other instances two, three, and even four symbols were read in a single fixation. However, as a rule the perception span does not encompass whole characters, excepting those of one or two symbols, but narrows to include generally one and occasionally two or three unitary parts of the character. It appears, then, that the symbol is more commonly the perceptual unit in shorthand reading than is the character. Perception proceeds in this manner because of the complexity given to the character by its symbols and the varied functions which the symbols serve. A brief explanation of these functions is given below.

A symbol may denote an entire word as in many of the simpler characters and common word-signs, or it may express a syllable or a consonant or vowel sound as in the longer characters. In this respect the symbol serves a purpose similar to that of letters and syllables in print. For example, some of the letters of the alphabet, such as a and i, may be used singly to denote words, and in

connection with certain combinations of other letters they may express syllables. The printed syllable, of course, is used only as the part of a word. However, the capacity of the isolated letter to express words is much more limited than is the corresponding property of the symbol. It is evident that only very few letters of the alphabet may denote entire words, while a great variety and number of symbols in shorthand may serve this purpose.

Through modification in its length, shading, or position, the symbol may serve still other functions. In this characteristic the symbol finds no parallel in the common forms of printed expression. Some of the symbols may be shortened to half of their usual length and thereby have certain letters or words added to their meaning. Thus ., meaning <u>in</u>, may be so changed into ., meaning in-the. The light symbol ., meaning <u>hope</u> may be written heavy, as ., to express <u>but</u>. The symbol ., when written in first position, means <u>dollar</u>, but when lowered to third position, as ., means <u>did</u>. Further, a symbol may, without changing any of its physical properties, express one meaning in a certain context and a different meaning in another. Thus . may denote <u>dollar</u>, <u>had</u>, or possibly other meanings.

These illustrations should be sufficient to show the kaleidoscopic nature of the symbol. They confirm the observation drawn from the photographic record that in effective reading the symbols must, as a rule, be perceived separately. They provide explanation for another fact which the records of the silent reading show concretely, that is, shorthand reading in general is highly analytic.

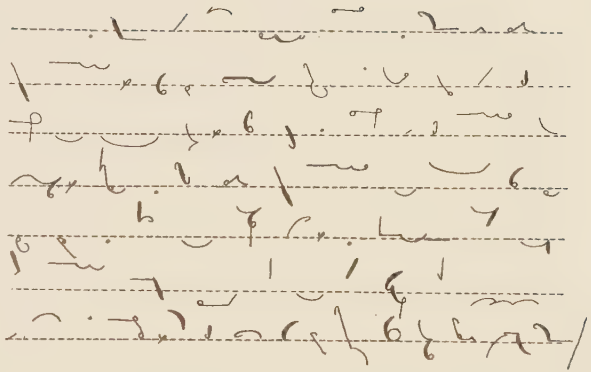
A second factor which, in part, accounts for the great number of fixations in this form of reading is the compact nature of shorthand writing. As indicated above, the symbol may represent a single consonant or vowel sound, a syllable, a word, or a combination of words. In a few instances the combinations include as

many as three words, such as ....., which means as-they-are. The symbols are comparatively small and compact in order that they may be quickly executed in writing. The linear space occupied by shorthand characters of normal size is considerably less than that required by the print which expresses their meaning. This fact is clearly illustrated in Plate V. Obviously the typewritten letters used here are larger than those used in the more common forms of print. However, their greater size accounts for only a small margin of the difference between the linear extent of the characters and their print equivalents. It is apparent from the comparison shown in the plate that the characters on the whole represent a much greater concentration of meaningful elements within a given space than do the corresponding printed expressions. Hence in shorthand reading progress is necessarily slower and fixations are more concentrated within a given section of the content than in the reading of print.

Duration of Fixations

Table XXVI shows the average duration of the fixations made in reading. These numbers range from 6.1 units required by an advanced student to 20.0 units required by a beginner who read indirectly. The fixations made by the various groups are much less varied in duration. The median periods of fixation are 13.2 units and 11.8 units for the two groups of beginners and 11.7 units and 9.5 units respectively for the intermediate and advanced students. The median duration of the fixations made by the four groups is 11.4 units.

Typical records of the reading done by the two students who read with the shortest and the longest fixations respectively are presented in Plates VI and VII. In reading her first selection subject 4D, an advanced student, made fixations which average 7.7 units in duration. Examination of her record, Plate VI, shows that her



The book which I-am sending-you describes the work of-a certified public accountant. This is-a growing profession and affords opportunities which do-not exist in any-other field. There-has been a scarcity of trained accountants for many-years. At-present the number-of certified public accountants in-the entire United-States is-not sufficient to-supply the demand in New-York-City alone. The technical knowledge needed by-the accountant can-be secured at any large university at-a minimum of time and expense. Why do-not more young people prepare themselves for-this pleasant-and lucrative work?

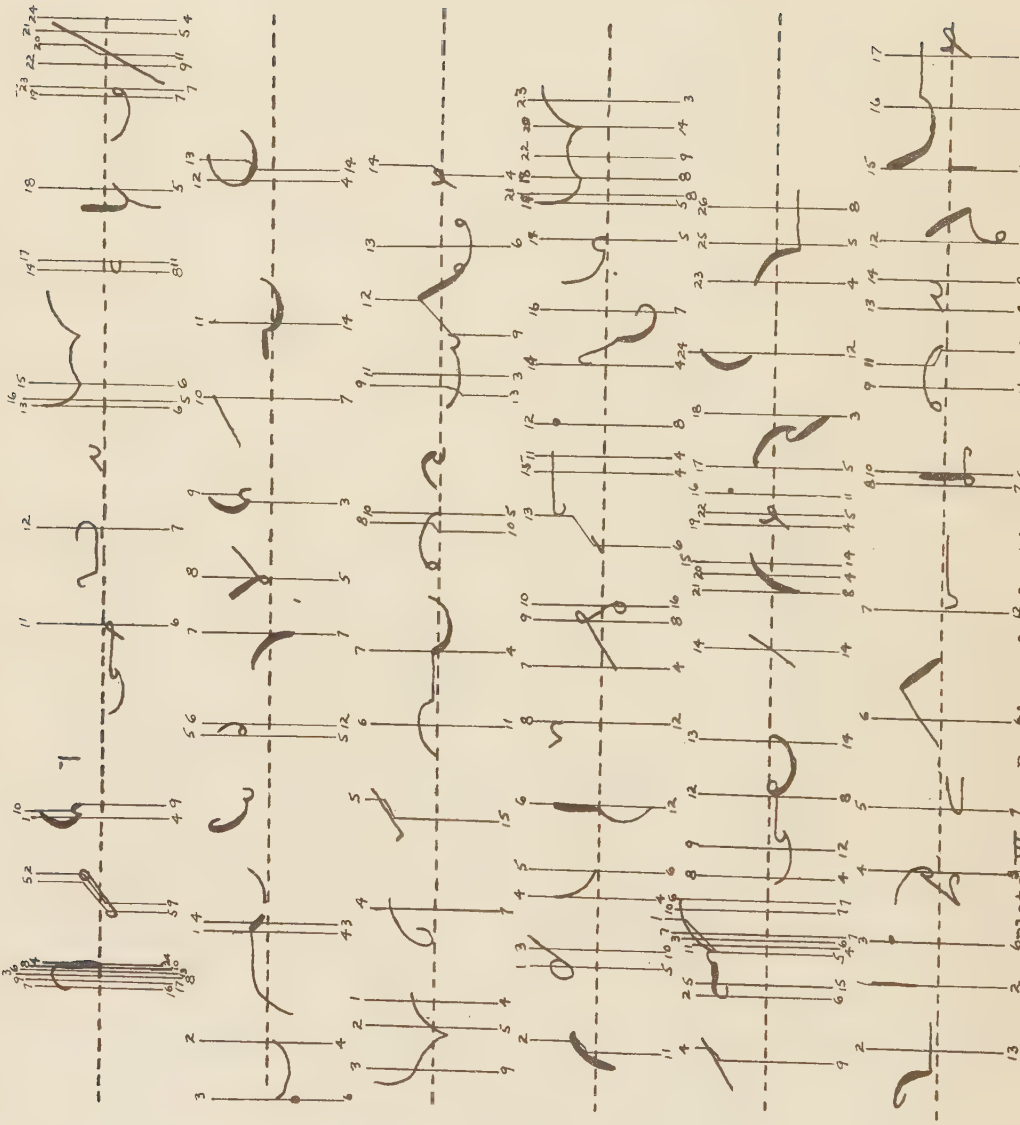
Plate V. A copy of Selection IVd accompanied by its verbal transcription. This transcription corresponds, line for line, with the shorthand writing in the selection.

TABLE XXVI

AVERAGE DURATION OF PAUSES MADE BY GROUPS A, B, C, AND D IN READING FOUR GROUPS OF SELECTIONS

Group A, Three Selections			Group B, Three Selections			Group C, Three Selections			Group D, Four Selections		
Subjects	Pauses Average Duration	Pauses A.D.	Subjects	Pauses Average Duration	Pauses A.D.	Subjects	Pauses Average Duration	Pauses A.D.	Subjects	Pauses Average Duration	Pauses A.D.
7A	10.5	2.0	3B	7.3	0.9	13C	9.2	0.8	4D	6.1	0.9
6A	10.8	1.4	6B	9.9	1.5	3C	9.3	0.8	9D	7.8	1.1
1A	11.5	2.1	1B	11.0	2.8	1C	9.9	1.5	2D	7.9	0.9
2A	12.6	2.4	4B	11.1	3.4	8C	10.5	1.2	12D	8.4	1.3
4A	12.7	4.2	9B	11.7	1.6	16C	10.8	2.1	7D	8.6	0.8
11A	13.2	2.6	2B	12.3	2.0	4C	11.2	1.1	11D	9.0	1.4
3A	13.4	4.8	5B	13.7	1.4	2C	11.4	1.6	5D	9.5	1.1
8A	15.0	3.2	7B	15.6	5.0	14C	11.4	1.5	6D	9.7	1.2
5A	16.0	5.1	8B	16.0	4.3	11C	11.8	2.1	13D	10.0	1.9
10A	18.2	7.2				12C	12.2	2.0	3D	10.1	1.4
9A	20.0	3.3				15C	12.3	2.1	1D	10.2	1.3
						5C	12.3	1.9	10D	12.0	1.6
						7C	13.0	2.6	8D	15.1	1.5
						10C	13.0	2.7			
						6C	13.8	3.4			
						9C	14.5	2.5			
Median	13.2	3.1		11.8	2.2		11.7	2.0		9.5	1.2

Note: The median duration of pauses for all students is 11.4 units.



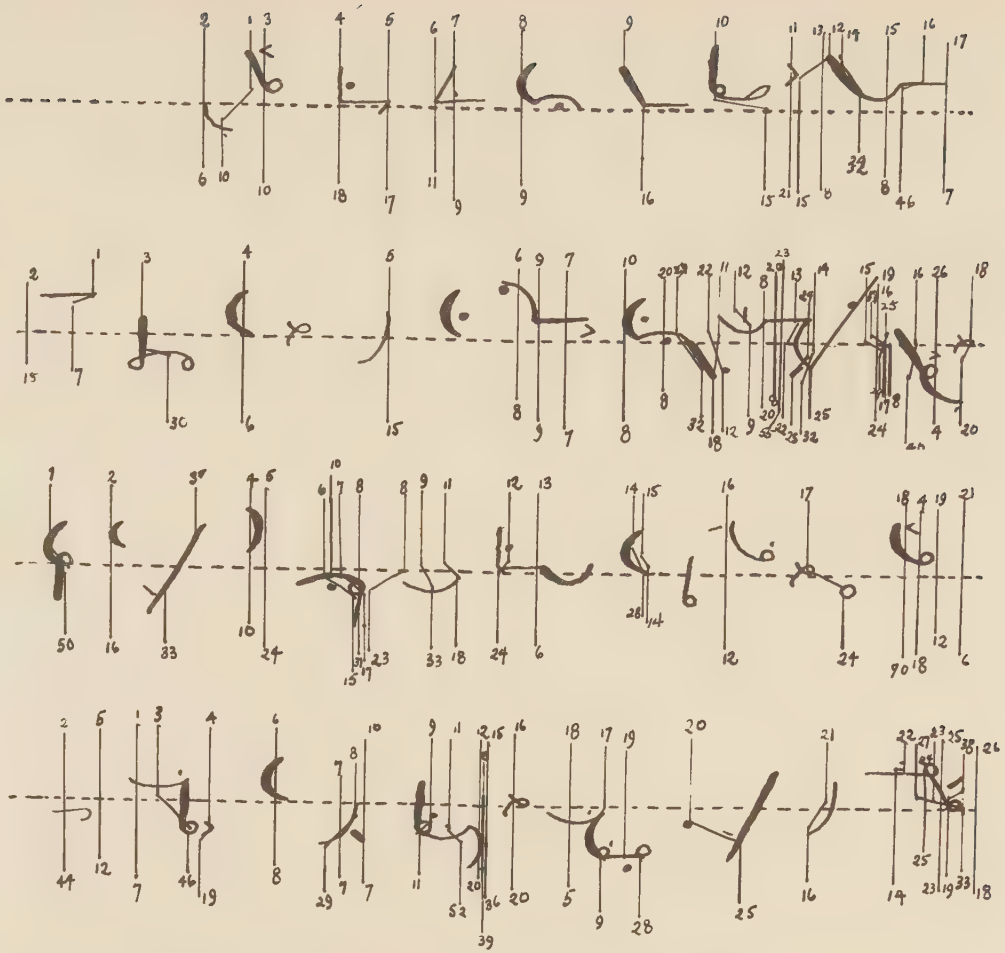


Plate VII. Reading of Selection Ia by Subject 9A.

fixations range from 2 to 19 units and that they were distributed fairly regularly over the material. Subject 9A, a beginning student, made fixations which average 20.9 units in reading her first selection, Plate VII. Her fixations range from four units to the extremely long period of 70 units, or nearly three seconds. In addition, her attention to the various characters was much less uniformly distributed than was that of the advanced student. The beginning student required approximately one-third more fixations per line than did the advanced student; however, the two readers made virtually the same number of regressive movements per line.

The facts noted in this comparison indicate that the beginning student experienced much more difficulty in reading than did the more mature reader. They show, too, that the duration of the fixations in shorthand reading varies widely with different readers. An examination of the data of Table XXVI reveals that the beginners reading indirectly represent the widest and the intermediate students show the least individual variations in the duration of their fixation pauses.

Long periods of fixation are an important characteristic of shorthand reading. The median duration of the fixations of all students who read silently, 11.4 units, is nearly twice as great as the corresponding measure of the fixations made by typical high-school students in the silent reading of printed material (3, p.31). The greater length of the fixations in shorthand reading signifies that more reflection accompanies or follows perception than in ordinary reading. It indicates that the shorthand reader must very carefully examine the symbols and characters and that during and after the examinations she must make comparisons and deductions as in thinking. When a reader prolongs a fixation pause to 70 units or to only 20 units, which is the median duration of pauses made by Subject 9A in reading three selections, one cannot safely conjecture

what part of the time of such pauses was devoted to active perception and what part was used in rationalizing on the meaning of the material perceived. Indeed thinking in some measure must accompany any form of effective reading; however, in shorthand reading the thought processes are focused much more definitely upon the perceptual aspects of the vehicle of expression than in the more general forms of reading.

Number and Nature of Regressive Fixations

As previously indicated, approximately one-third of the fixations made by the entire body of students were regressive. The numbers of regressive fixations per line made by the members of each group are shown in Table XXVII. The numbers range from 3.3 regressions per line, made by a beginning student, to 27.6 regressions made by an advanced student. These values represent individual differences which are far greater than the corresponding variations in any other of the measures of eye movements. However, the group medians of the regressive movements, which range from 7.5 to 10.2 regressions per line for Groups B and D respectively, vary somewhat less widely than do the median group values for pause duration. The latter measures range from 9.5 units for Group D to 13.2 units for Group A. The silent readers, as a whole, averaged 9.2 regressions per line.

The large proportion of regressive fixations is indicative of the peculiarly detailed manner in which shorthand writing is read. The records show that such reading does not proceed in an orderly succession of forward fixations such as generally characterize the ordinary reading of high-school students, but that the reader's advance is interrupted frequently by refixations on characters which, wholly or in part, have already been perceived. Plate VIII presents a record of the eye behavior of a student who made an average number of 9.7 regressions per line in reading the selection.

TABLE XXVII

REGRESSIVE FIXATIONS MADE BY GROUPS A, B, C, AND D IN READING FOUR GROUPS OF SELECTIONS

Group A, Three Selections		Group B, Three Selections		Group C, Three Selections		Group D, Four Selections	
Subjects	Average No. of Regressions Per Line	Subjects	Average No. of Regressions Per Line	Subjects	Average No. of Regressions Per line	Subjects	Average No. of Regressions Per Line
1A	3.3	4B	3.7	4C	5.5	8D	5.5
4A	5.8	3B	4.1	8C	5.7	2D	6.0
3A	7.1	6B	6.9	1C	6.1	3D	6.0
6A	8.2	2B	7.1	3C	6.4	10D	7.1
5A	8.6	7B	7.1	2C	7.1	13D	7.8
9A	8.7	1B	7.7	6C	7.7	6D	9.1
11A	9.1	9B	12.7	7C	8.7	1D	10.0
10A	11.2	8B	13.7	9C	9.4	9D	10.5
2A	12.4	5B	14.6	13C	10.2	4D	11.9
7A	12.9			5C	11.9	5D	12.2
8A	13.8			10C	13.2	12D	14.4
				12C	14.6	7D	15.7
				11C	16.6	11D	27.6
				14C	18.2		
				16C	18.5		
				15C	21.2		
Median	8.8		7.5		10.0		10.2

Note: The median number of regressions per line for all students is 9.2.

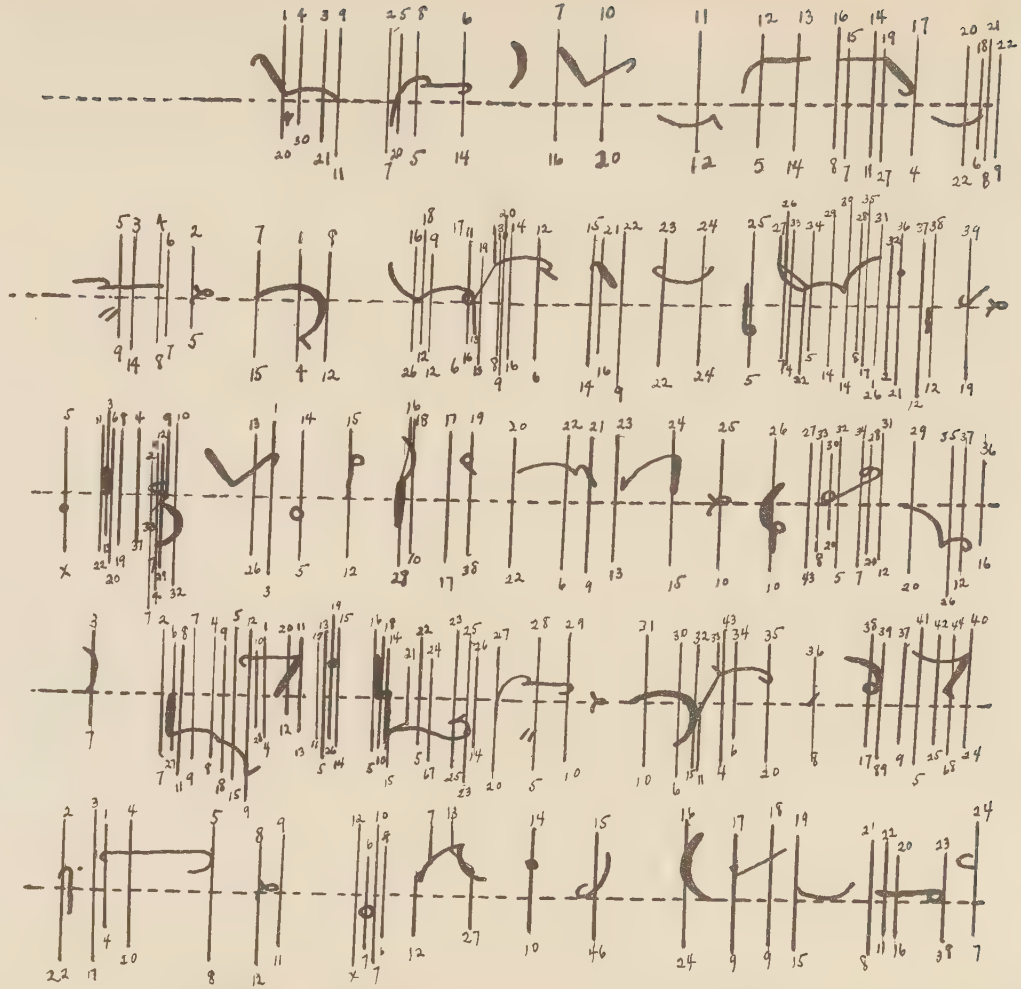


Plate VIII. Reading of Selection IIa by Subject 7B.

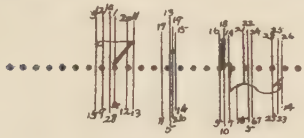
his number is but 5 per cent greater than the median number of regressions per line for all students; hence in respect to the numbers of regressions the record is representative of the readings in general.

The lack of even progression in reading is very evident in the record. The reader made at least one regressive fixation on each of 27 characters, or more than half of the contents of four lines of the selection. Four of these characters received two refixations each, and four others were refixated on three times. More than a fourth of all of the fixations were regressive. The order of the fixations shows that the reader's attention frequently meandered back and forth between different characters and occasionally between parts of the same character.

The record above noted illustrates the three types of regressions which are frequently made in shorthand reading. Those made near the beginning of the line constitute a very common type. In passing from the end of one line to the beginning of the next the readers nearly invariably make an oversweep of the first and occasionally the first two or three characters. The reading of these characters usually follows the first fixation and is characterized by a large proportion of regressive fixations. Approximately a third of all of the regressions were made on the material preceding the point where the first fixation falls. The oversweeps do not generally effect economy of time or of perception since the overswept material is usually later perceived as carefully as the remaining contents of the line. As the initial fixations are, on the average, no greater in duration than the other fixations of the reader, it is not likely that the first fixations serve as wider surveys of the adjoining material than do the other fixations. Thus the initial overleapings in shorthand reading appear to be made independently of the context. Evidently they are perfectly

natural eye movements which are caused by the momentum normally acquired by the eye in its rapid swing from the far end of the previous line.

The second type of regressions is illustrated by the oscillations of attention between adjoining characters and between more widely separated parts of the line. The record of the fixations made by Subject 7B in reading three characters in the fourth line of Selection IIA is here reproduced from Plate VIII.



(courage and determination-of)

In reading the last two of these characters, the reader made one short fixation, the 13th, on ....., following which she fixated once on the first part of the next character which is a long and difficult one. Then she refixated on the previous character and next on the following one. Twice more she regressed to the small character ....., then glanced once at the character preceding it. Finally, she returned to the long character and finished reading it in six more fixations, one of which was regressive.

The refixations made on the one or two characters immediately preceding the one on which attention was last directed are the most numerous type of regression. Such regressions indicate that the reader may employ essentially a trial and error procedure on those parts of the material which, apparently, are the most difficult for her. The frequent reference to previous characters implies that verification of the meaning given them narrows the line of attack on the character in question.

The third type of regressive fixations is exemplified in the reading of ....., family, by Subject 7B. Plate VIII shows that she read this character in manner as follows:

Three of the ten fixations made on this character were regressive. The order of the fixations shows that the reader began with one regressive fixation on the first symbol; then she passed over the second symbol, or glimpsed it peripherally, and fixated on the third symbol. Apparently she was unable to interpret the character from these three perceptions, as she next regressed to the second symbol. Following this long fixation on the middle of the character she made three forward fixations on or near the ends of the third symbol. Finally she refixated on the middle symbol for a short time and concluded her perception of the character with a long fixation on the last symbol.

Plate IX more vividly illustrates the necessity of some students to refixate many times in reading certain characters. Careful examination of the reading of ....., meaning matter-of, shown in this plate reveals that 14 of the 34 fixations made on this character were regressive. Obviously the accuracy of this count is conditioned by the limitations within which the exact order of the fixations may be detected from the photographic film and recorded. However, granting reasonable variation from accuracy, the numbers and locations of the fixations show that the reader worked over the character in minutest detail and that he repeatedly reread the character in effort to interpret it. The entire reading of this student, who was the only male subject among the silent readers, is characterized by extraordinarily large numbers of fixations and regressions on many of the characters. Although this reader was obliged to make persistent and detailed analyses of a relatively large proportion of the characters, his final grasp of the thought of the passages appeared to be above the average for all students.

The illustrations of intra-character regressions drawn from Plates VIII and IX typify, on average and extreme scales respec-

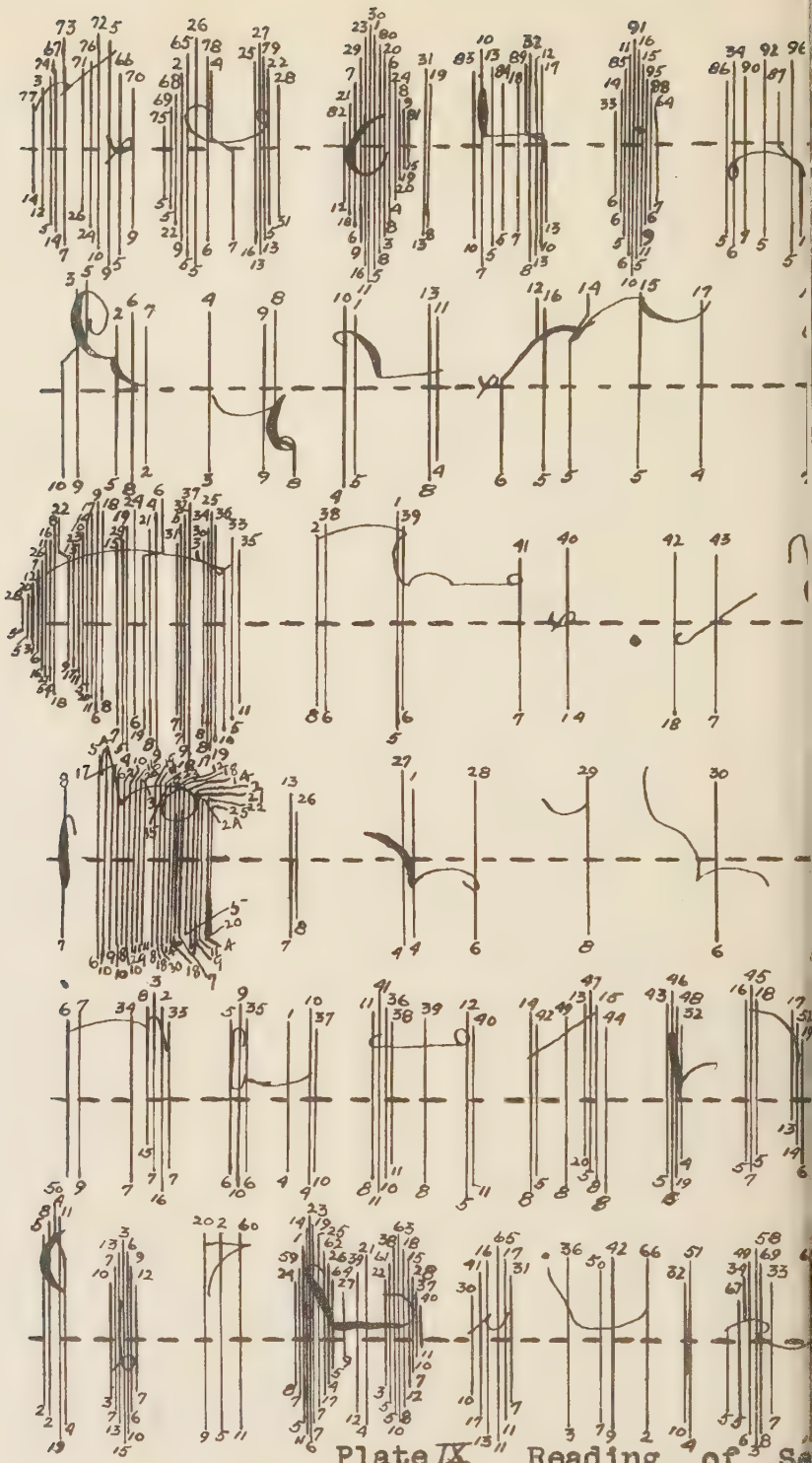
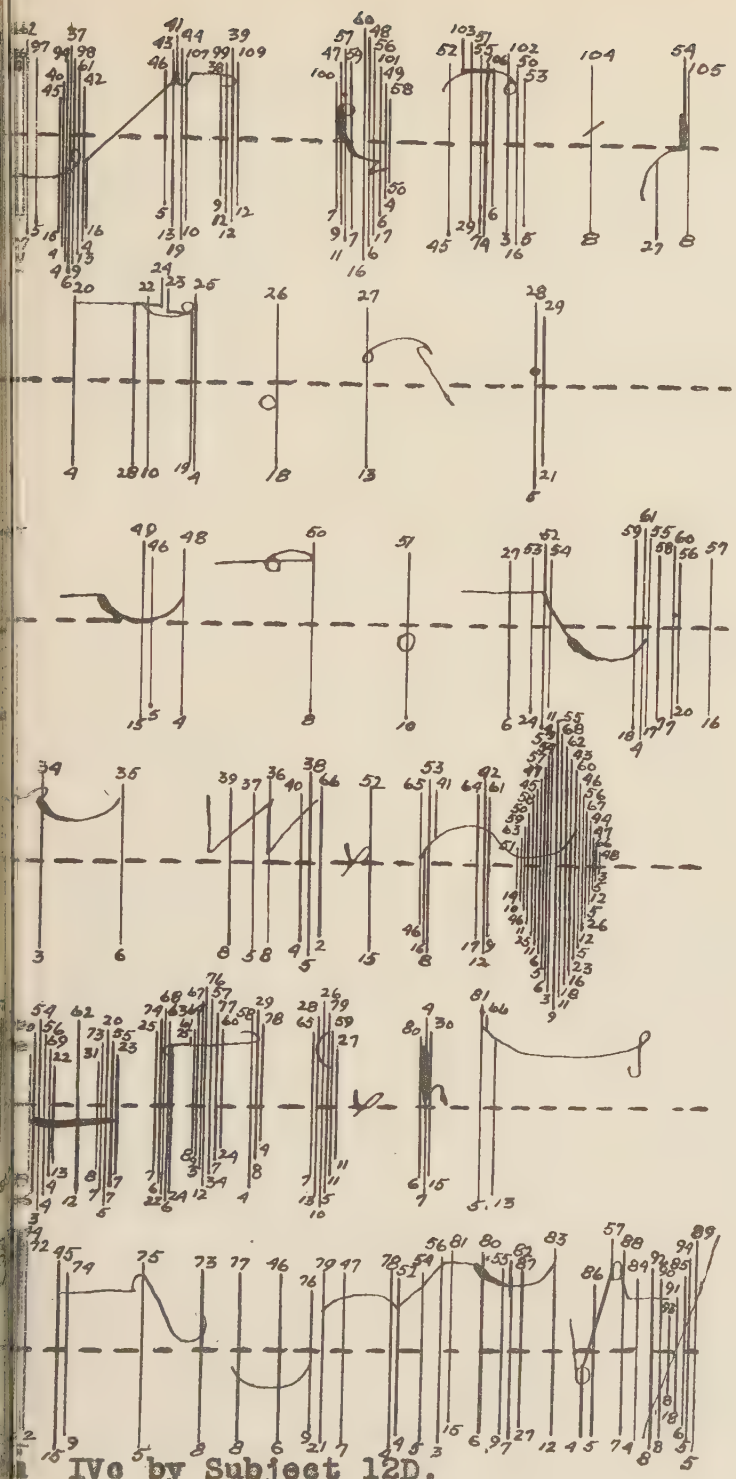


Plate IX. Reading of Se



IVc by Subject 12D.

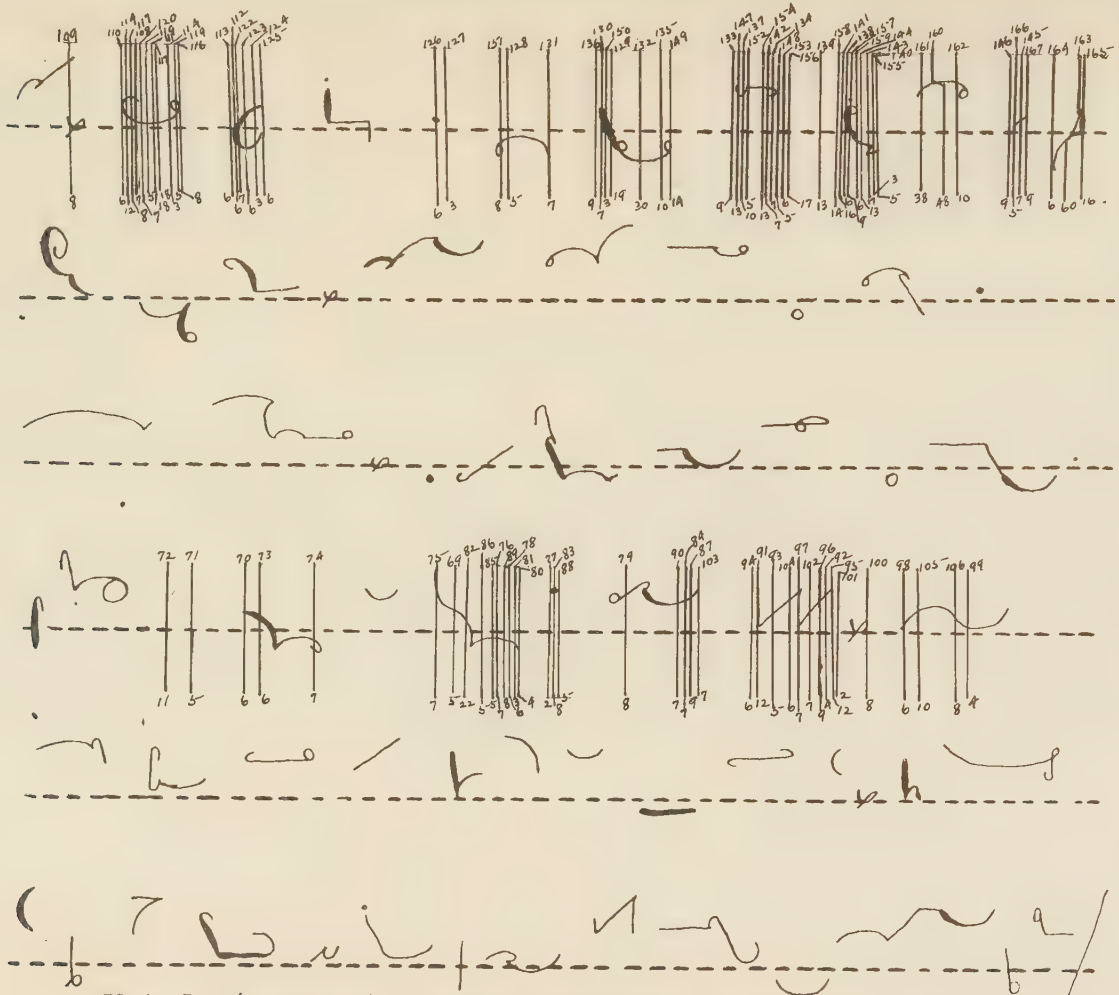


Plate IX (continued). Reading of Selection IVc by Subject 12D.

tively, the manner in which the readers in general directed and redirected attention to many of the more difficult and longer characters. The order of such regressions and their prevalence indicates that most of the readers occasionally and some of them frequently were unable to recognize various symbols in a single perception, but that they must reperceive them one or more times. The relationship of the symbols to each other and to the whole character and the nature of the context in which the character occurs are undoubtedly important factors in conditioning the order and number of regressions of this kind.

Time Required in Reading

Table XXVIII reports the average periods of time per line used by the students in shorthand reading. The groups most homogenous in this respect are the beginners learning by the indirect method and the intermediate students. However, in these groups the fastest readers read about three times as rapidly as the slowest onès. The swiftest readers in the other groups advanced approximately four times as fast as the slowest ones. In light of these wide individual variations and the small size of the groups no significant differences, in the rate of reading, appear between any of the group records. Also in consideration of these factors, the differences between group medians of the time per line used in the silent reading of the printed selection, which were reported in Table XXIV are so small that they have practically no significance.

In Figure 4 the relation between the individual rates of reading printed and shorthand material is represented graphically. The figure shows that virtually no agreement exists between the rates at which the two forms of material were read.

It should be pointed out here that the students' reading of shorthand material such as was used in this investigation is essen-

TABLE XXVIII

TIME USED BY FOUR GROUPS OF STUDENTS IN READING FOUR GROUPS OF SELECTIONS

Group A, Three Selections		Group B, Three Selections		Group C, Three Selections		Group D, Four Selections	
Subjects	Reading Time Per Line	Subjects	Reading Time Per Line	Subjects	Reading Time Per Line	Subjects	Reading Time Per Line
1A	202.3	3B	133.2	1C	239.3	2D	165.2
4A	308.6	4B	228.1	3C	257.2	4D	191.5
6A	358.7	6B	237.4	8C	268.7	3D	218.6
3A	376.8	1B	265.4	4C	273.0	9D	258.9
7A	396.9	2B	319.7	13C	315.2	6D	261.0
11A	446.9	7B	332.8	2C	320.9	13D	286.5
2A	470.5	9B	421.1	6C	400.3	12D	310.2
5A	491.6	8B	504.8	5C	404.8	1D	318.7
8A	571.6	5B	519.2	7C	422.2	8D	348.8
10A	627.9			11C	476.7	5D	353.3
9A	631.2			12C	487.1	10D	378.8
				9C	504.7	7D	380.8
				10C	528.6	11D	676.5
				14C	591.1		
				16C	660.2		
				15C	727.4		
Median	437.5		312.5		416.7		306.2
P.E. of Med.	42.67		47.20		41.92		30.32

Note: The median period of time per line for all students is 368.7 units.

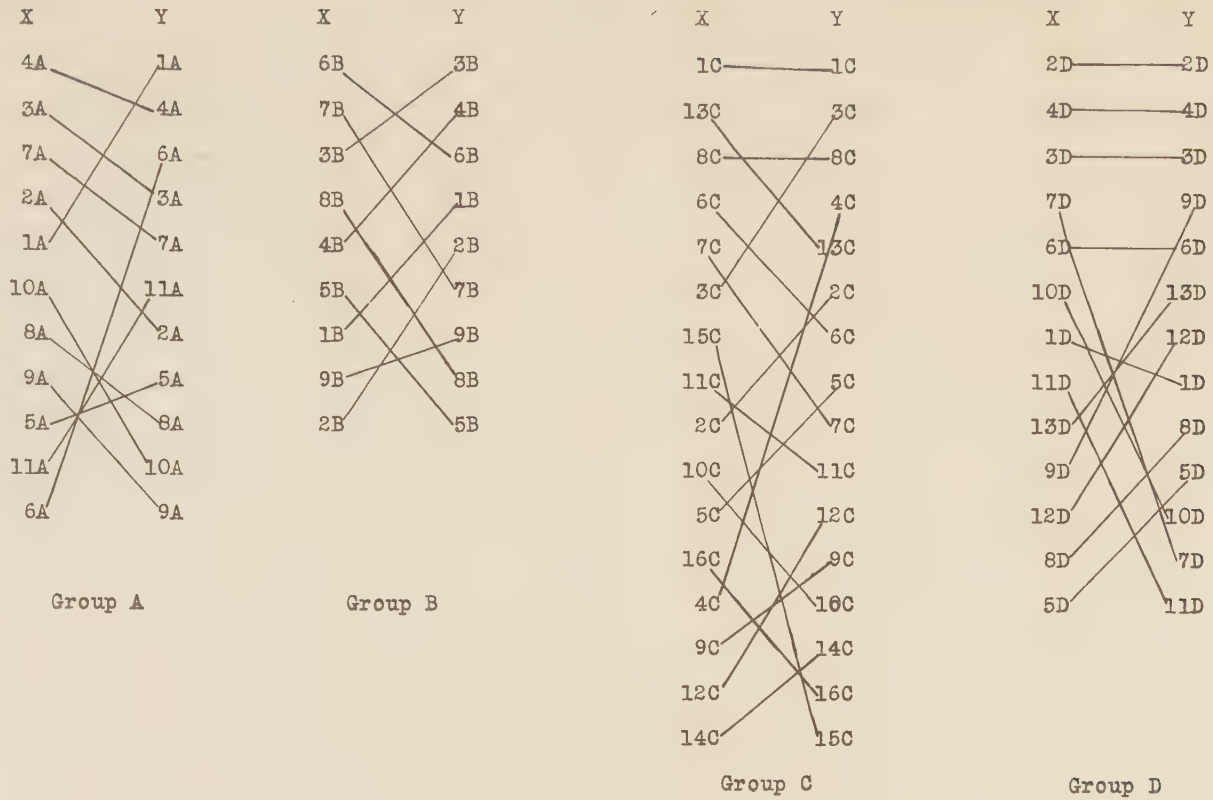


Figure 4. Graphical representation of the relation between the rates of reading print (X) and the rates of reading shorthand (Y) for four groups of silent readers.

tially different from the interpretation of notes which the reader has written from dictation. The reading of selected material written in standard form differs from note reading in the following respects.

First, in reading notes written from dictation the reader may be able to recall the meaning of a considerable part of the material through the auditory impressions received during the dictation. In reading entirely new material the subjects in this study could make no use of auditory experience of the type above noted.

Second, in writing notes the student or the stenographer often employs devices in phrasing and individual variations in shading, alignment, character forms, etc., which are peculiar to her own style of writing. The standard form of Munson shorthand was used in all of the selections, and none of the writing had been done by the students. Hence in interpreting these selections the subjects were denied the reading advantage of the personal qualities which would probably appear, in appreciable degree, in their own writing.

Thus one may suppose that the subjects in this study would read shorthand which they had written from dictation much more rapidly than they read the selections. This investigation supplies no data on this point as the study aims primarily to identify the processes which are used in the shorthand reading of students and to determine, if possible, whether significant differences exist in the nature of the reading done by the students in different levels of training. It appeared that, for these purposes, writing of standard quality would serve much better as reading material than would shorthand notes written by the students during dictation.

Summary of Chapter

1. The students who read silently showed wide individual differences in intelligence, rate of reading printed material, and previous accomplishment in shorthand. However, the group variations in these respects are not sufficiently pronounced to have affected appreciably the records made by the groups in shorthand reading.

2. Shorthand reading in comparison with the reading of printed discourse requires extremely large numbers of fixations. The students made a median number of 31.9 fixations per line in the shorthand reading. The fixations are much more numerous than in reading print because, (a) a much shorter perception span is employed in reading shorthand than in reading print, and (b) shorthand writing is relatively more compact than is printed expression. The meaning conveyed by a line of shorthand requires approximately a line and a half when expressed in print of ordinary size.

3. In reading shorthand the symbol is more generally the unit of perception than is the character. In reading print words and phrases are commonly perceived in a single perception. The symbol may serve a variety of purposes by virtue of its great diversity of size, shape, shading and position. It is much more diversified in these respects than is any comparable unit of printed expression, such as a letter, syllable, word, or phrase. This property of the symbol lends a complexity to the process of reading which necessitates large numbers of regressive fixations and long perception pauses in reading.

4. Approximately one-third of the fixations made by the students who read silently were regressive. Three kinds of regressions may be identified in the records of the reading.

a. Regressions were made on the first two or three characters in the line. These regressions represent

unintentional oversweeps of the first few characters and are due apparently to the momentum acquired by the eye in changing its focus rapidly from the end of one line to the beginning of the next line.

b. Refixations were made on characters previously read and on widely separated parts of the line. These regressions appear to have been caused by the complexity of shorthand which forces the reader to regress in order to reinterpret entire characters or merely to verify the meanings already given.

c. Regressions were made within a single character. The order in which these fixations were made shows that apparently the reader did not recognize certain symbols in the first survey of the character and hence was obliged to regress to them in order to interpret the character.

5. The median duration of all of the fixations made by the students is 11.4 units. Group variations in the median duration of the fixations range from 9.5 units for those made by the advanced students to 13.2 units for those made by the beginners employing the indirect method of learning. The length of the fixations made in shorthand reading suggests the likelihood that more reflection accompanies or follows perception in this type of reading than in reading print.

6. In general the wide individual variations which are found in the rates of the students' reading of print are paralleled by similar variations in their rates of reading shorthand. No apparent relation, however, exists between the rates of reading shorthand and printed material.

CHAPTER VII

NATURE OF THE DEVELOPMENT OF STUDENTS' ABILITY TO READ SHORTHAND

Introduction

One of the purposes of the silent reading experiment was to determine, if possible, the nature and extent of growth in reading ability which students experience in six months of shorthand study. As previously noted, records of the eye movements made by each group of silent readers were secured at the beginning, in the middle, and at the end of the experiment. A comparison of the records made by some of the groups at different readings reveals whether significant gains in reading skill were made within the experimental period. The numerical data from the reading of certain groups are, however, inconclusive in this respect. In the present chapter interpretative comparisons of the students' records which were secured in different stages of the experiment will be made. In these comparisons the facts provided by analytic study of the individual cases will be used to supplement the numerical data represented by the group records.

Initial Stages in Reading Shorthand

Beginners learning by the indirect method.- Table XXIX presents a summary of the mean records of eye movements made by Group A at the different readings. The numbers representing the measures obtained at each reading are arranged in rows across the table. Examination of these data shows that this group of students increased their mean numbers of fixations and regressions at each successive reading and that they shortened the length of their fixation pauses at each of these readings. Figure 5 provides a

graphical representation of these data. It may be seen from this figure and Table XXIX that the proportion of the regressions in the entire number of fixations is perceptibly larger for the second and third readings than for the first one. On the other hand, the fixation pauses made at the first reading are relatively much larger than is the duration of pauses of the last two readings.

TABLE XXIX

MEAN RECORDS OF EYE MOVEMENTS MADE BY GROUP A (ELEVEN SUBJECTS) AT THREE READINGS

Reading	Fixation Pauses		Regressions		Duration of Fixation Pauses	
	Mean No. Per Line	P.E. of Mean	Mean No. Per line	P.E. of Mean	Mean	P.E. of Mean
First	26.1	1.81	5.3	.69	19.2	.99
Second	28.5	2.63	8.2	.74	13.3	.73
Third	39.8	1.81	13.0	1.30	11.6	.61
Difference between mean records made on first and third readings	13.7	2.56	7.7	1.47	7.6	1.17

The differences between the mean records of the eye movements made by this group at the first and last readings and the probable errors of the differences appear as the last row of data in the table. Comparison of these differences with their probable error shows that the differences are statistically valid in each of the measures of eye movements. By the same test, however, none of the differences between similar records from consecutive readings are reliable. It seems clear that such reading skill as may be developed in beginners in a three-months period of learning shorthand by the indirect method is generally insufficient to affect appreciably the character of their eye movements in reading.

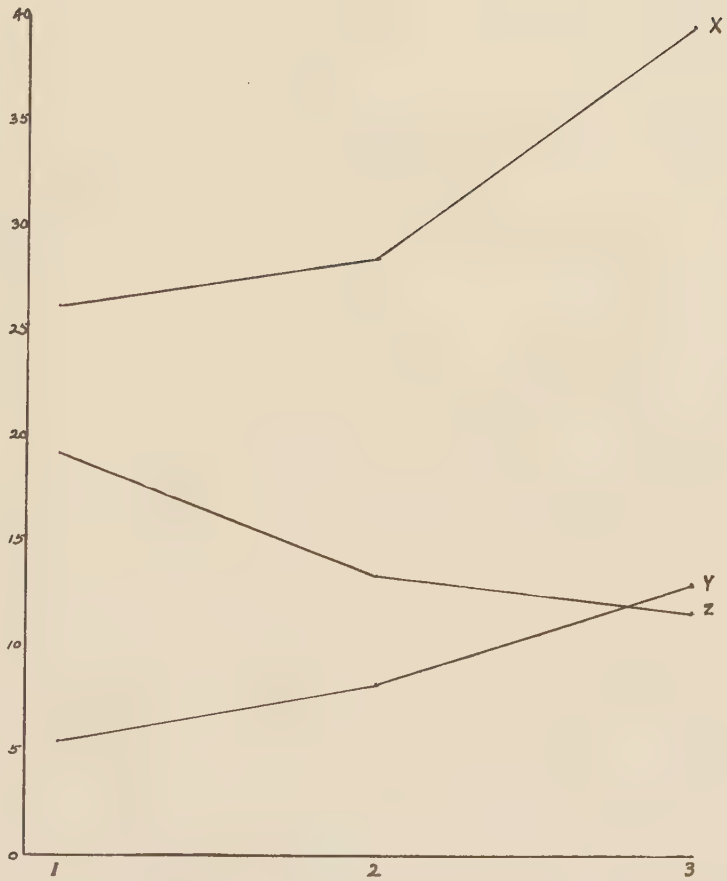


Figure 5. Graphical representation of measures of eye movements made by Group A at three readings. Numbers 1, 2, 3 on base line denote readings which were separated by intervals of three months. Curve X represents the mean numbers of fixations per line; Curve Y, the mean numbers of regressions per line, and Curve Z, the mean duration of fixation pauses.

At the end of a six-months period, however, the readers show a marked tendency to make many more fixations and regressions per line and to read with much shorter perception pauses than at the beginning.

Beginners learning by the direct method.- Table XXX presents a summary of the mean records of the eye movements made by Group B at different readings. It may be seen from these data that, in each of the measures, this group made its best record at the second reading. The numbers of fixations and regressions made at the final reading were appreciably larger than those made initially while the duration of the pauses was less at the third than at the first reading.

It may be observed that the difference between the group records made at consecutive readings are not valid in light of their probable errors; however, the uniform superiority of the records made at the second reading cannot be attributed wholly to chance variations in reading and to the small size of the group. Possible variations in the difficulty of the selections used in different stages of the experiment may have enabled Group B to make their best records at the second reading. In fact, it appears likely that, allowing for extraneous factors which cannot be evaluated, Group B exemplified the same general tendencies in reading as have been shown for Group A. In the main, both groups show a substantial increase in the number of fixations and regressions required at the final reading over the numbers made initially and a corresponding decrease in the length of their fixation periods.

Differences in the character of the reading done at different stages of the experimental period are illustrated by the records of the first, second, and third readings of Subject 2B which are shown in Plates X, XI, and XII, respectively. Her first

TABLE XXX

MEAN RECORDS OF EYE MOVEMENTS MADE BY GROUP B (NINE SUBJECTS) AT THREE READINGS

Reading	Fixation Pauses		Regressions		Duration of Fixation Pauses	
	Mean No. per Line	P.E. of Mean	Mean No. per Line	P.E. of Mean	Mean	P.E. of Mean
First	29.2	2.13	7.9	.91	12.1	.51
Second	21.8	2.53	5.6	1.14	10.0	.58
Third	34.2	3.32	12.3	1.81	10.9	1.02
Difference between mean records made at first and third readings	5.0	3.94	4.4	2.05	1.2	1.11

reading was marked by nearly twice as many fixations as were the other readings. The fixation pauses made at the second reading were 1.4 times as long as those of the first reading and 2.4 times as long as those of the final reading. The reader made her largest number of regressions (4.7 per line) on the first reading, slightly less than half of this number on the second reading and nearly as many regressions on the last as on the first reading. The concentration of fixations on a few characters is evident in the record of the first reading while in the second and third readings the fixations were distributed much more uniformly over the reading material. This subject appears to have made substantial progress in reading ability during the first half of the experimental period but registered little, if any, gain during the second half of the period.

The type of progress made between readings which has been described above for Subject 2B is paralleled more or less closely by two other members of Group B. The records denoting

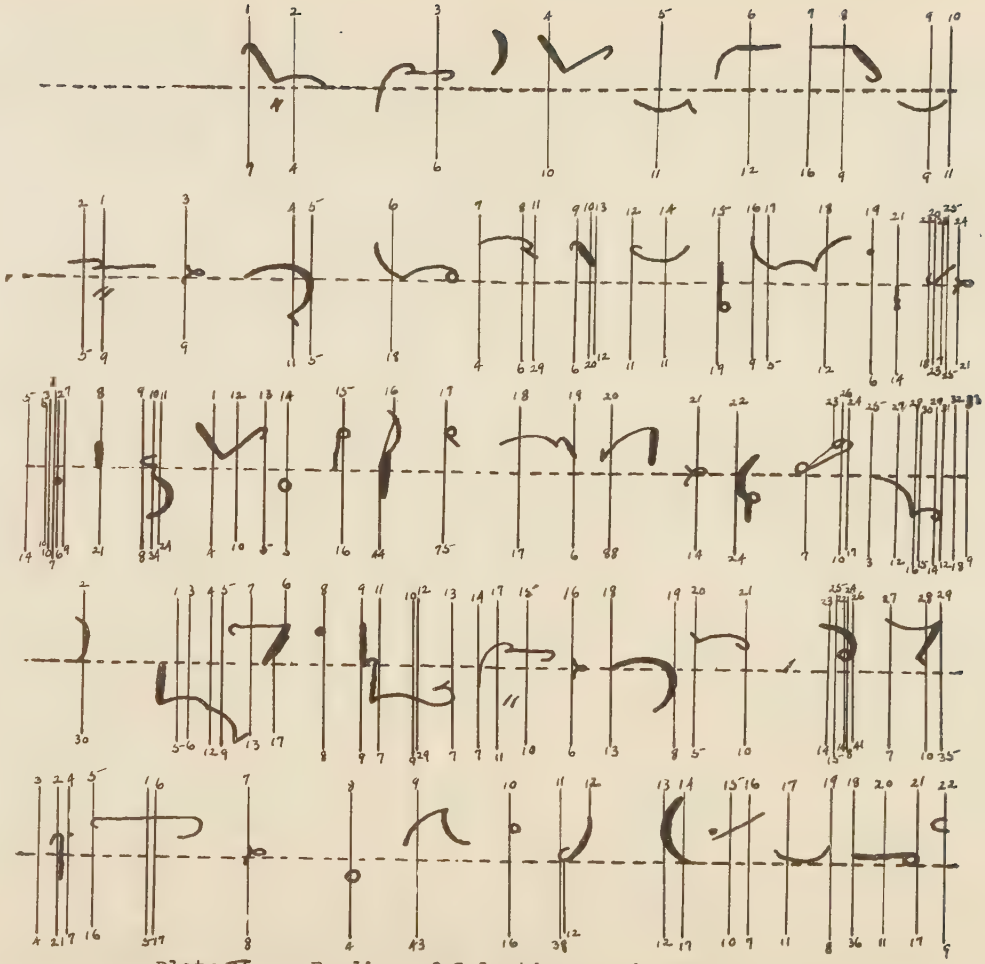


Plate X. Reading of Selection IIa by Subject 2B.

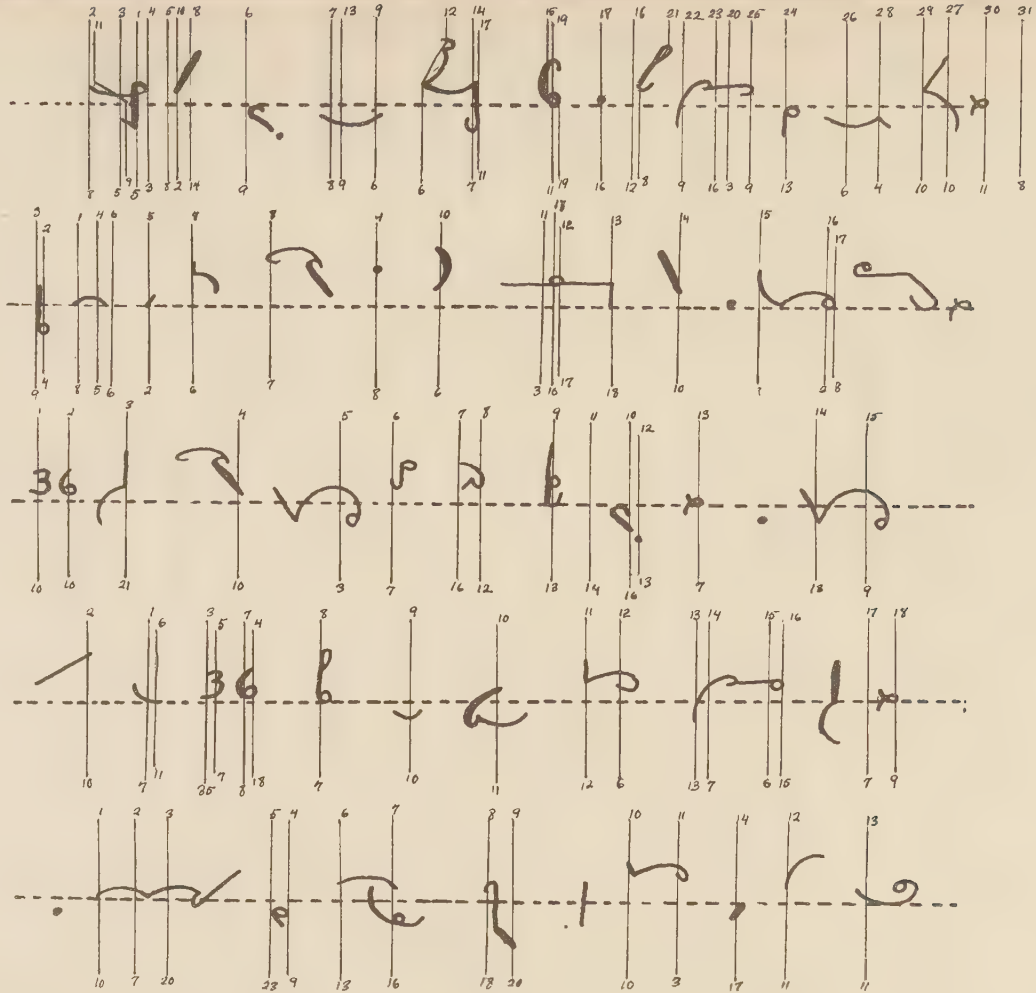


Plate XI. Reading of Selection IIb by Subject 2B.

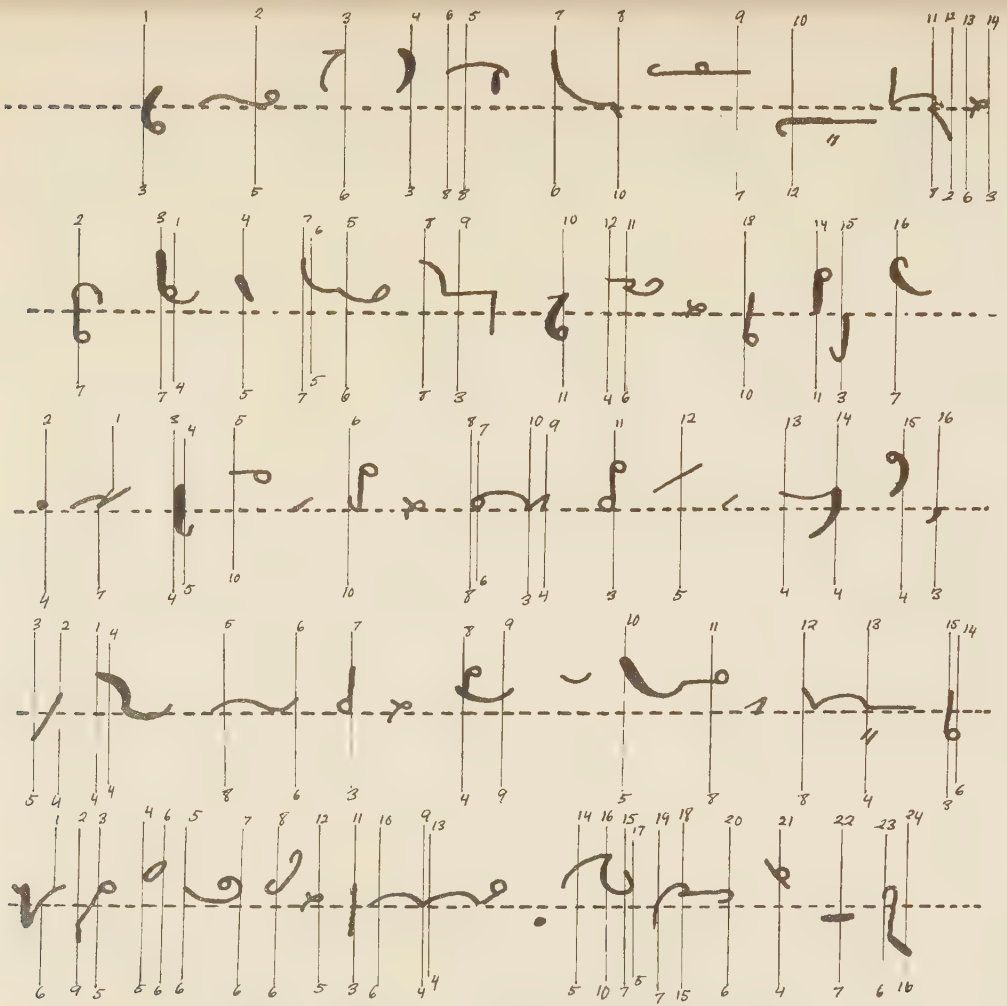


Plate XII. Reading of Selection IIc by Subject 2 B.

the measures of eye movements made by these subjects at different readings are presented numerically in Table XXXI and graphically in Figure 6. The similarity of the curves in the figure indicates that the three subjects progressed in the same general direction so far as growth in perceptual powers and skill in recognition are concerned.

TABLE XXXI

MEAN RECORDS OF EYE MOVEMENTS MADE BY THREE MEMBERS OF GROUP B AT THREE READINGS

Measures of Eye Movements	First Reading; Subjects			Second Reading; Subjects			Third Reading; Subjects		
	2B	6B	4B	2B	6B	4B	2B	6B	4B
Mean number of fixations per line . . .	27.2	22.7	29.0	16.2	13.0	15.2	17.7	18.7	27.7
Mean number of regressions per line . . .	4.7	5.5	8.0	2.2	1.7	3.2	4.2	5.0	9.5
Mean duration of fixation pauses . .	14.7	8.2	11.0	10.7	7.0	7.3	6.0	6.6	10.1

Evidence of another type of development in reading is provided by the records of Subject 9B which are presented in Plates XIII, XIV, and XV. This subject, also a beginner learning by the direct method, made smaller numbers of fixations and regressions on the first and second readings than did any other member of her group. On the final reading, however, her numbers of fixations and regressions were next to the highest among those made by her group. It may be seen by comparing Plates XIII and XIV with Plate XV that this subject read the first two selections in a manner totally unlike that employed on the third. The last line and four

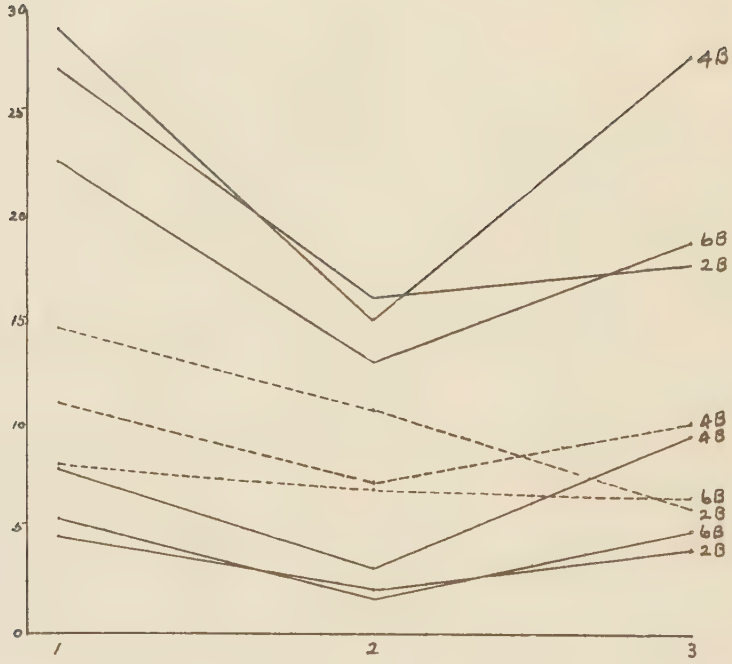


Figure 6. Graphical representation of measures of eye movements made by Subjects 2B, 4B, and 6B who were beginners learning by the direct method. Numbers 1, 2, 3, on base line denote readings which were separated by three-month intervals. The curves at the top of the figure represent mean numbers of fixations per line; those at the bottom denote mean numbers of regressions per line, and the broken-line curves represent mean duration of fixation pauses.

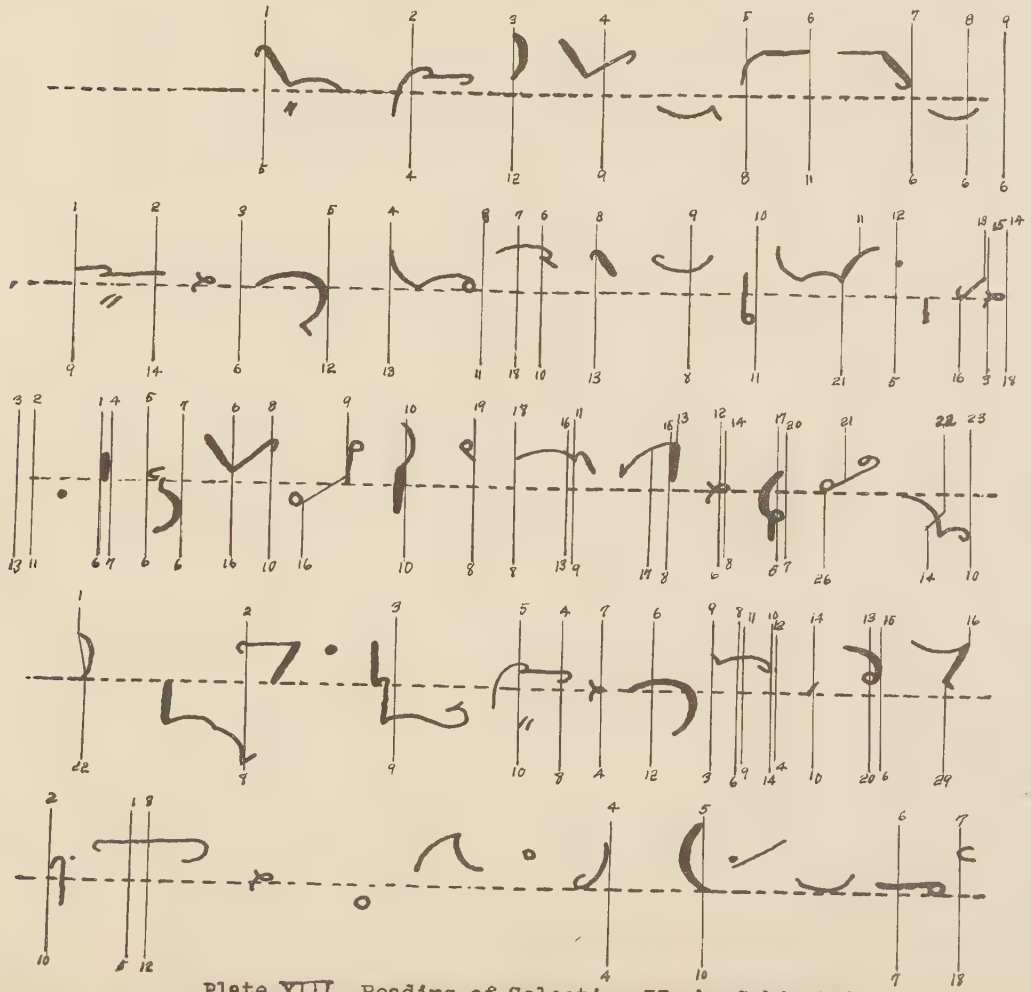


Plate XIII. Reading of Selection IIa by Subject 9 B.

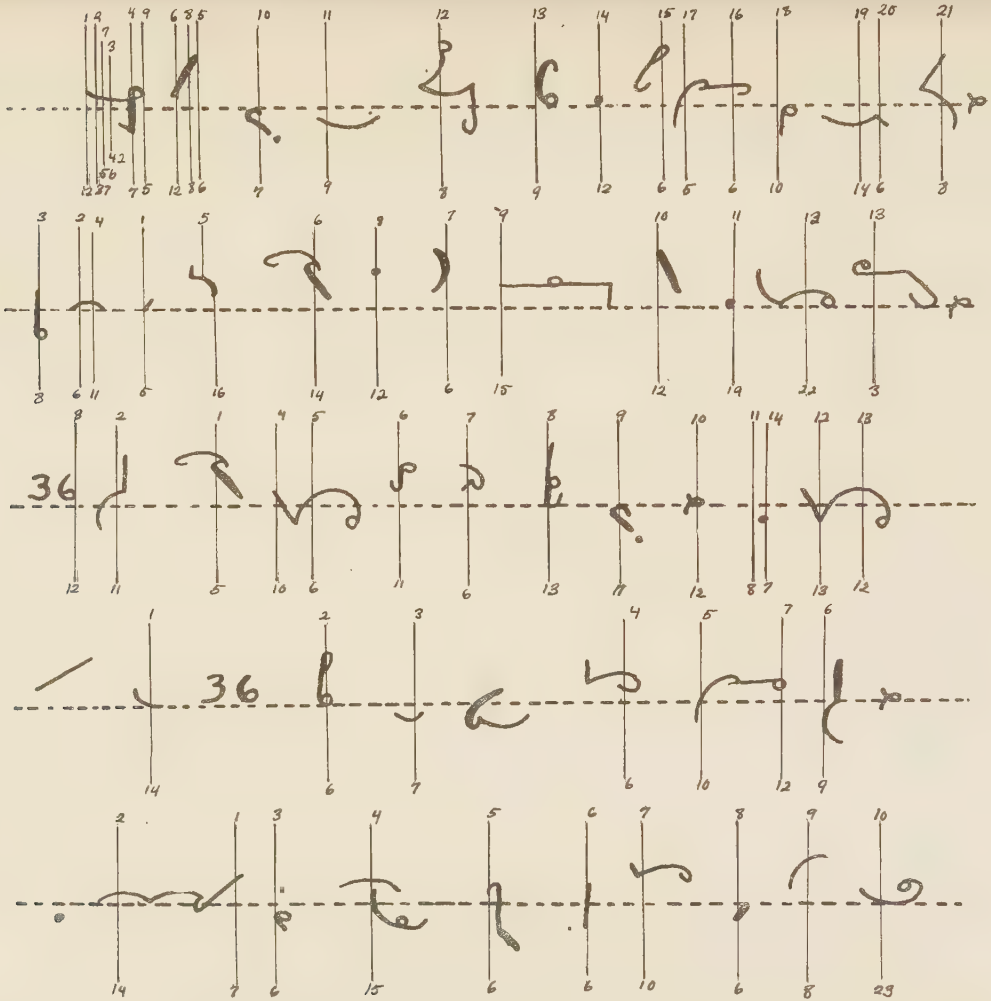


Plate XIV. Reading of Selection IIb by Subject 9B.

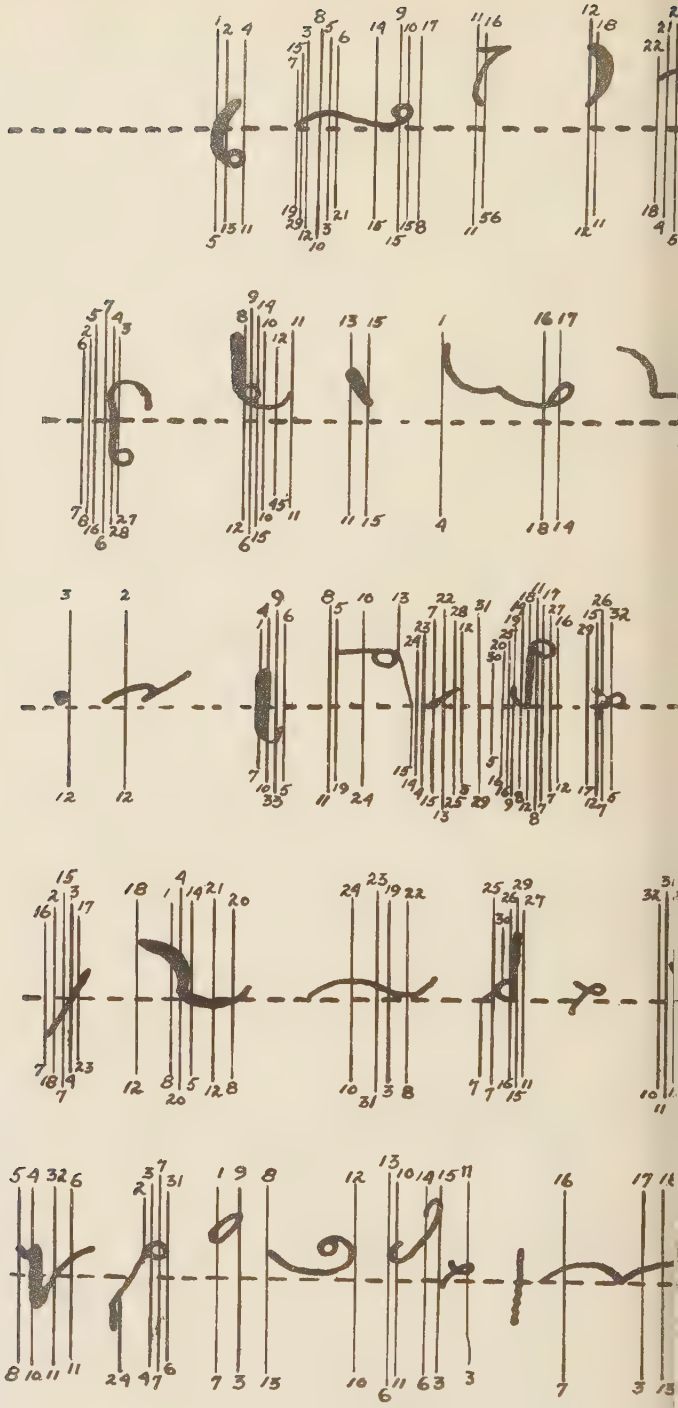
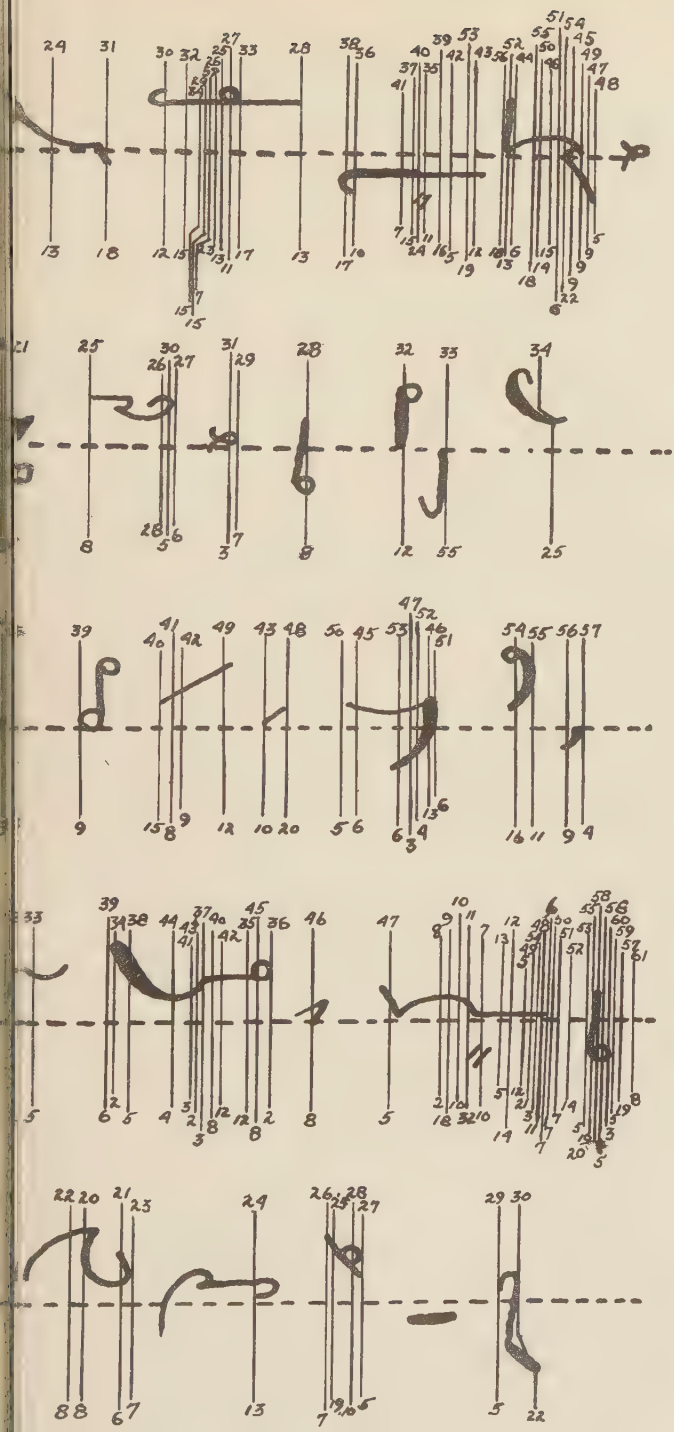


Plate XV. Reading o



ion IIc by Subject 9 B.

characters in the preceding line of the first selection received such scant attention that the reader could not possibly have apprehended their meaning. The next to the last line in the second selection received but six fixations; very likely the reader did not fully understand the contents of this line. The other parts of the first two selections were perceived with sufficient regularity and thoroughness that the reader probably understood their meaning. Since more than three-fourths of the responses of this subject on the comprehension test were satisfactory, she was not required to reread any of the selections.

The nature of the reading done by Subject 9B on her third selection contrasts strikingly with that done on the selections above noted. While only two characters in the first two selections received as many as three fixations each, half of the characters in the third selection received four or more fixations, and nearly a fifth of the characters were fixated six or more times. Five times as many regressions per line were made in reading the last selection as in reading the first two; however, the fixation pauses made at the three readings vary but slightly in length. The third reading is characterized by detailed analysis of much of the material and by evidences of difficulty in interpreting relatively simple characters. For example ..... are, required four fixations and ..... of, received five fixations in the third reading. In the first and second readings ..... escaped direct attention and ..... was read in a single fixation.

The wide differences appearing in the records of Subject 9B from her first two and last readings are paralleled by the records of two other members of Group B. Figure 7, which is a graphical representation of the records of Subject 9B, illustrates the general characteristics of the eye behavior at the three readings. Comparison of this figure with Figure 6 emphasizes the fact that

records of different subjects exemplify different courses of development in learning to read shorthand. The students whose records approximate those of Subject 2B, initially make large numbers of fixations and regressions and subsequently gain in power, more or less regularly, to read with fewer perceptions and regressions. They also reduce perceptibly the duration of their pauses. Subjects such as 9B appear to read well in initial stages of their study; however their later performances in reading indicate that they have not acquired sufficient mastery of symbols and skill in their recognition to read efficiently. Such students may read superficially at times but when later confronted with similar material they demonstrate a lack of mastery of important principles in the structure and usage of many of the simpler characters. Consequently their reading is marked by numerous regressions, detailed analyses of characters and slow and irregular progress in interpretation.

Reading of Intermediate Students

The records made by the intermediate students at three readings are presented in Table XXXII. These students, like the beginners learning by the indirect method, made their best records at the second reading. However the differences between the measure of eye movements made at the second and third readings are very small and in light of the probable errors of these measures the differences are of no significance.

A comparison of records made at the first and last readings shows that all of the measures of eye movements made at the last reading are perceptibly less than the corresponding measures from the first reading. Indeed, it may be noted from the table that none of the differences between the records of the first and last readings are statistically reliable. However, the validity

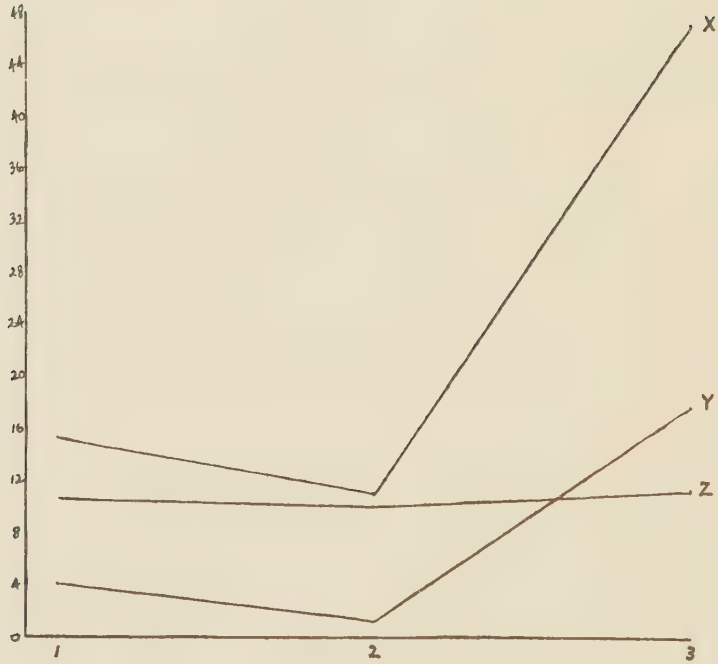


Figure 7. Graphical representation of the records of eye movements made by Subject 9B at three readings. Numbers 1, 2, 3 on the base line represent three readings which were separated by three-month intervals. The curves are designated as follows: mean numbers of fixations per line, X; mean numbers of regressions per line, Y; and mean duration of fixation pauses, Z.

of these differences is probably greater than their probable errors indicate since the differences are consistently in favor of the records from the last reading.

TABLE XXXII

MEAN RECORDS OF EYE MOVEMENTS MADE BY GROUP C (SIXTEEN SUBJECTS) AT THREE READINGS

Reading	Fixation Pauses		Regressions		Duration of Fixation Pauses	
	Mean No. Per Line	P.E. of Mean	Mean No. per Line	P.E. of Mean	Mean	P.E. of Mean
First	42.6	3.72	13.5	1.58	14.0	.71
Second . . .	34.5	2.28	10.5	1.02	10.6	.43
Third	35.4	1.78	10.6	.91	10.9	.35
Difference between mean records made at first and third readings	7.2	4.12	2.9	1.82	3.1	.78

Figure 8 represents the relationship between the initial and final records made by the intermediate students. Inasmuch as the records made at the final reading are essentially the same as those made at the second reading it may be assumed that these students as a group developed perceptibly in reading ability during the first half of the experimental period. It is possible that the students in this level of training hadreached, at the time of the second reading, a stage in which further skill in reading would be acquired very slowly and that the subsequent three months period was insufficient for them to acquire additional measurable skill. As previously noted, the beginners showed a general tendency to make more fixations and regressions on the last than on the first reading. On the contrary, the intermediate students

improved in both of these measures of reading ability. During the experimental period the students in both levels of training materially gained in power to read with shorter periods of perception.

Reading of the Advanced Students

The records made by the advanced students at the different readings are shown in Table XXXIII. These students unlike all other groups made their largest numbers of fixations and regressions at the second reading. While no reliable differences exist among the records made by the advanced students on consecutive readings, the numbers of fixations and regressions made on the initial and final readings may be validly compared. The comparison indicates that the students read less efficiently at the end than at the beginning of the experiment. Two factors may be noted here which may have contributed to this result. First, variations in the difficulty of the selections may have affected

TABLE XXXIII

MEAN RECORDS OF EYE MOVEMENTS MADE BY GROUP D (THIRTEEN SUBJECTS) AT THREE READINGS

Readings	Fixation Pauses		Regressions		Duration of Fixation Pauses	
	Mean No. per Line	P.E. of Mean	Mean No. per Line	P.E. of Mean	Mean	P.E. of Mean
First	25.5	1.92	7.7	.83	9.2	.54
Second . . .	40.5	4.66	13.6	1.67	8.9	.40
Third	34.8	1.35	11.7	1.24	9.9	.49
Difference between mean records of first and third readings	9.3	2.34	4.0	1.49	.7	.73

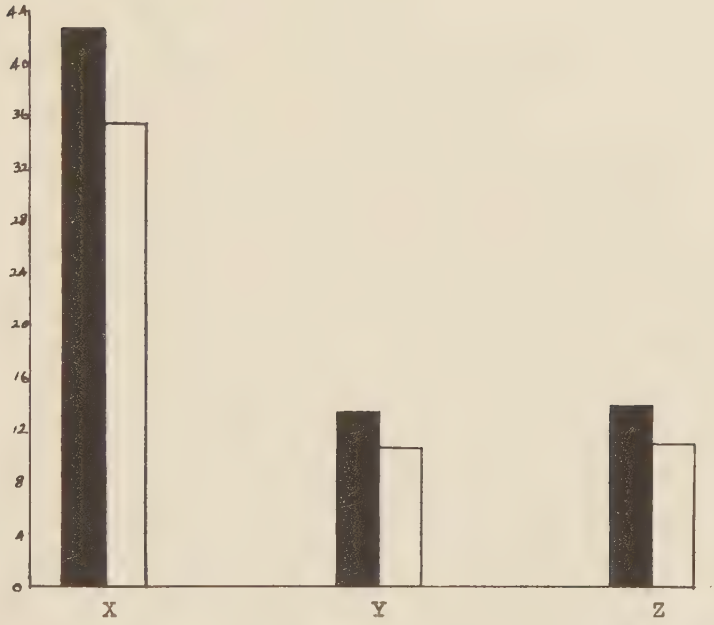


Figure 8. Graphical representation of the mean records of eye movements made by Group C (intermediate students) at the first and third readings. The shaded columns represent the records from first reading and the unshaded column represents records of the third reading. X denotes mean numbers of fixations per line; Y, mean numbers of regressions per line; and Z, the duration of fixation pauses.

materially the records made at the first and third readings. Second, the record made at the final reading may have been impaired by circumstances which demanded considerable attention from the advanced students at that time. Among these were final examinations, and various matters incident to graduation.

Certain differences in the nature of the reading done at different intervals are not disclosed by the comparisons of group data. These differences are revealed only through examination of the photographic records. For example, Subject 4D whose records throughout the experiment are among the best of her group, made 28 per cent more fixations per line and 64 per cent more regressions per line on her last than on her first selection. Also her fixation pauses at the last reading were 10 per cent longer than those made initially. However, the photographic records of these readings which are presented in Plates XVI and XVII indicate that this subject read her last selection perhaps even more skillfully than she did the first one. On the first reading (Plate XVI) she did not fixate on two rather difficult characters ..... and ..... and gave apparently scant attention to two others, ... and ..... which are not generally easy to read, although not one of the simplest characters escaped direct fixation. The uneven distribution of fixations on easy and difficult characters leads one to suspect that the reader missed the meaning of various parts of the selection.

On the other hand, her reading of the last selection (Plate XVII) the first line of which is not included in the plate, shows that the subject was able to read, without direct fixation, only the simplest characters. The longer and more complex characters received more nearly their proportionate share of the reader's attention than in the reading of the first selection.

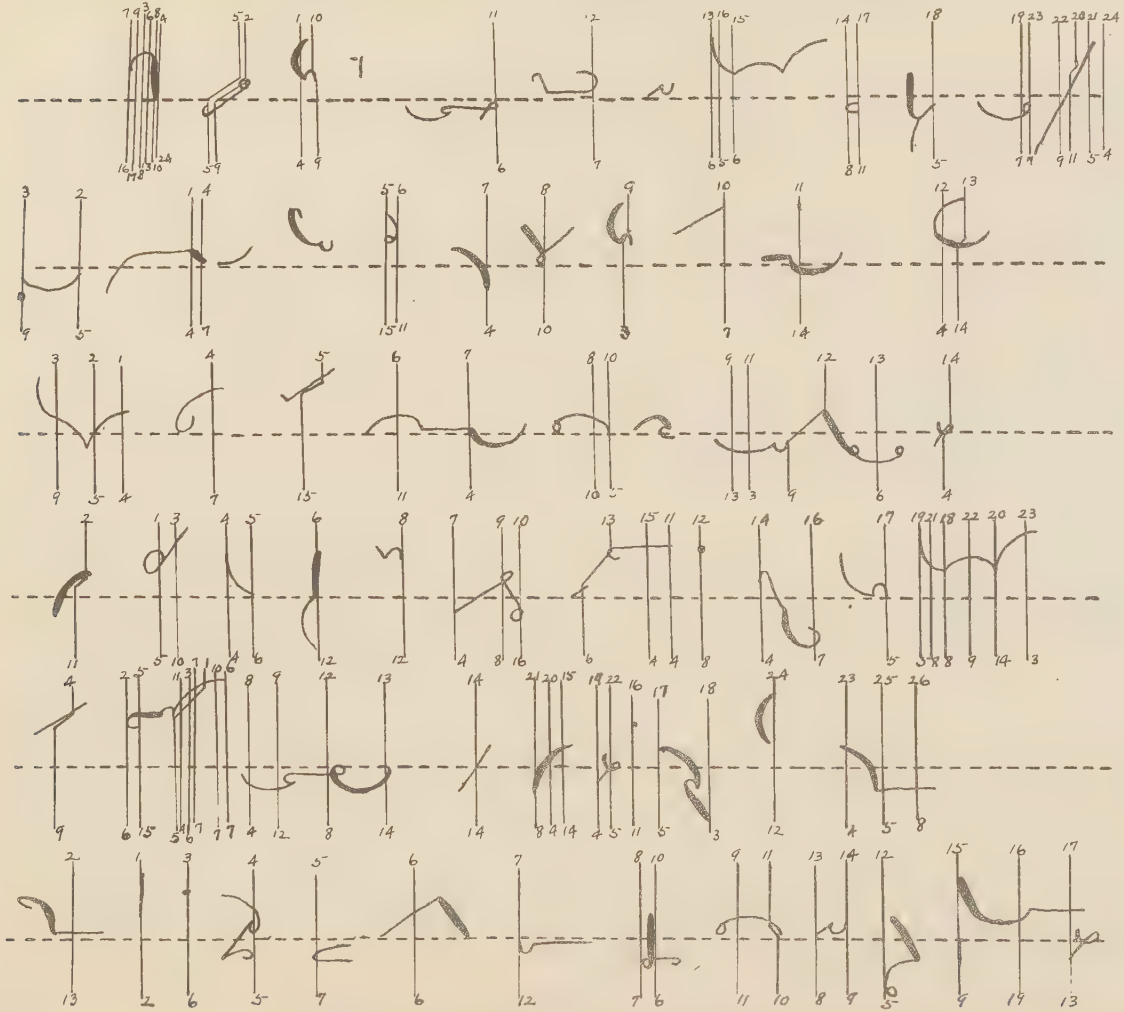


Plate XVI. Reading of Selection IIa by Subject 4D.

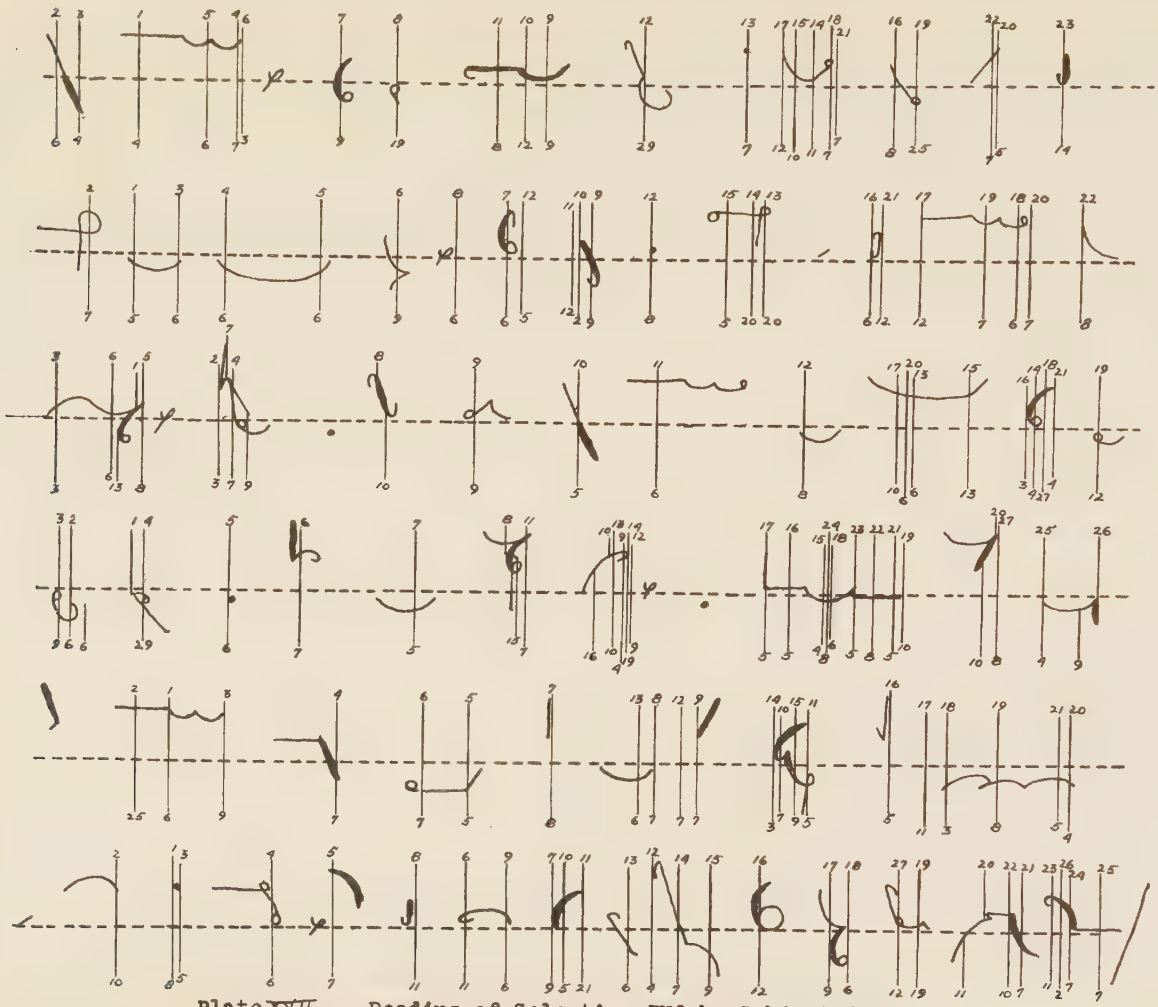


Plate XVII. Reading of Selection IVd by Subject 4D.

The location of the fixations and the order in which they were made at the final reading are such as to incidate that the reader fully comprehended the meaning of the selection. Hence in spite of the fact that the eye movements were more numerous and the pauses longer at the final than at the first reading, the subject appears to have acquired between these readings an appreciable degree of skill in recognizing word-signs and simple characters and in concentrating attention more effectively on the varingly complex parts of the material. The records of several other advanced students provide similar evidence of this type of development.

It may be recalled that both groups of beginning students also made substantially larger numbers of fixations and regressions at the end than at the beginning of the experiment. It is not improbable that the tendency of these students to increase their numbers of perceptions represents a modification of their habits of perception, discrimination and recognition in the direction of more efficient reading.

Comparison of Records Made by Students and Experts

Table XXXIV presents the mean records of the eye movements made by the respective student groups in their entire shorthand reading and the records made by the experts in reading the corresponding material. All groups except the students learning by the direct method made larger numbers of fixations and regressions than did the experts. The differences between the mean records of the students and experts are not statistically reliable, however, excepting in the duration of the fixation pauses made by the beginners learning by the indirect method and by the intermediate students. However, as the experts made consistently better records in all measures of eye movements than did Groups A, C, and

D, it may be assumed that in general the readers in none of these groups had reached the level of reading maturity represented by the stenographers.

The experts were apparently handicapped in reading the selections used with the direct-method students by the nature of the selections. This material is largely descriptive in character and bears slight resemblance in content to the material ordinarily written and transcribed by the stenographer. The other selections deal generally with more commonplace affairs and hence were read with less difficulty by the stenographers. The nature of the content read by the direct-method students had no corresponding effect on their reading since they were accustomed to this type of material.

TABLE XXXIV

COMPARATIVE RECORDS OF EYE MOVEMENTS MADE BY STUDENTS AT THREE READINGS AND BY EXPERTS IN READING THE SAME MATERIAL

Group	First Reading				Second Reading				Third Reading			
	Students		Experts		Students		Experts		Students		Experts	
	Mean No. of Fix. per Line	P.E. of Mean	Mean No. of Fix. per Line	P.E. of Mean	Mean No. of Reg. per Line	P.E. of Mean	Mean No. of Reg. per Line	P.E. of Mean	Mean Dur. of Fix.	P.E. of Mean	Mean Dur. of Fix.	P.E. of Mean
A	31.5	1.20	24.5	1.45	8.9	.69	7.1	.69	14.7	.69	9.9	.57
B	28.4	1.65	31.1	1.68	8.6	.84	10.3	.77	11.0	.59	10.3	.44
C	37.5	2.73	34.8	3.63	11.5	1.06	13.4	1.89	12.0	.41	9.1	.46
D	34.0	2.66	25.7	1.17	11.2	1.01	7.4	.46	9.5	.47	9.1	.40

In conclusion it appears that the beginners learning by the indirect method and the intermediate and advanced students were relatively less proficient in reading than were the stenographers. The differences between the attainments of the student groups cannot be determined because of necessary limitations in the study. The records of the direct-method students seem to approximate those of the stenographers more closely than do the records of any other group. However, the character of the reading material used in this case may have given undue advantage to the students. In addition, these students represent the smallest group, and it is possible that they were more carefully selected as subjects than were the other students.

Summary of Chapter

1. The beginners learning by the indirect method and the advanced students made larger numbers of fixations and regressions in reading at the end than at the beginning of the experiment. However, the fixation pauses of the former group were 60 per cent shorter at the final than at the first reading and those made by the latter group appear not to have changed appreciably in length.

2. The direct-method students also made larger numbers of perceptions at the final than at the first reading but the differences between their records from these readings are not statistically significant. The intermediate students, as a group, experienced no measurable development in reading ability during the second half of the experimental period. During the first half of the period they appear to have grown appreciably in the capacity to read with fewer perceptions per line.

3. An increase in the numbers of fixations and regressions per line may or may not mean a failure of the reader to grow significantly in reading skill. In some instances the character of

the eye movements, as shown by the photographic records of the reading, indicates that the student read more efficiently when making larger numbers of perceptions. Careful examination of the photographic records of individual reading reveals that different students exhibit essentially different forms of development of the ability to read shorthand.

4. A comparison of the records made by the students and the stenographers shows that in general the beginners learning by the indirect method and the intermediate and advanced students were perceptibly less proficient in reading than were the stenographers. The records of the direct-method students approximate those made by the stenographers more closely than do the records of any other group. However, because of the nature of the selections used with the direct-method students the records made by the stenographers in reading this material do not provide as fair a basis of comparison with the student records as do the stenographers' records made in reading the other groups of selections. The relative degrees of reading attainment of the different student groups cannot be determined in the study because of some unavoidable limitations on the size of the groups and the uniformity of the reading material.

5. Throughout this chapter the generalizations drawn from statistical comparisons of the data are conditioned by two factors; (1) the small numbers of cases in the various groups, and (2) the wide range of individual differences in the performance of the readers. In some instances these factors are such as to render invalid the results representing the differences in group accomplishment between various readings. Hence only the generalizations which appear warranted in spite of the statistical limitations of the data have been presented above as definite conclusions.

CHAPTER VIII

THE READING OF WORD-SIGNS, PHRASES AND OTHER CHARACTERS

Introduction

As previously stated, the characters in shorthand may be classified, by virtue of their usage, into word-signs, phrases, and other characters. In construction the characters of each class differ significantly from those of the other two classes. The word-signs are, as the term implies, merely signs for words. The characters representing word-signs are generally abridged in such way that only one or two of the most important phonic sounds of the word are indicated by the character. In interpreting these characters in context the reader may (1) identify some of them directly through knowledge of their meaning; (2) she may recognize the word elements expressed in the character and by inference pick up the remaining parts of the word, or (3) she may deduce the meaning of the omitted parts of the character by direct reference to the context. Indeed, the reader may use one or more of these means or a combination of them.

Phrase characters are abridged to a less extent than are word-sign characters. In addition the characters expressing phrases are generally much more complex than word-signs and more varied in construction. A variety of rules relative to annexing many of the common words to others and expressing them in phrase outlines lends a complexity to reading phrase characters which the reader does not experience in reading word-signs.

The class above noted as "other characters" includes the shorthand outlines which are not word-signs or phrases. Each

character of this group expresses but a single word. The character is usually so written that all or practically all important phonic sounds of its word equivalent are expressed by the outline. Hence the reading of these characters is fundamentally a process of interpreting directly and in proper order the various symbols composing them.

In the present chapter the results of an analysis of the reading of word-signs, phrases and "other characters" will be presented. The purpose of the analysis is to determine, so far as possible, the most important effects which differences in the construction and usage of the three types of characters have upon the reader's visual perception and interpretation of them.

Tabulation of Numbers and Kinds of Eye Movements
Made in Reading Three Types of Characters

Tables XXXV, XXXVI, and XXXVII present, respectively, significant measures of the eye movements which were made by Group A in reading the word-signs, phrases and "other characters" of their selections. Similar tables representing the records of the reading of each of the other groups of students were prepared. However, as these tables are long and their contents in general are well illustrated by the tables above noted, they are not included in the chapter. The manner in which the data of all of the tables were tabulated is explained briefly below.

In several instances a given word-sign appears two or more times in a selection. In all of these cases the data of the tables include only the eye movements which were made on the first reading of the word-sign. A comparison of the fixations made at the initial reading with those made at subsequent readings of the same word-sign in a single selection disclosed that the first reading usually required more and longer fixations than did the later readings. Thus by using data from the first readings only, the effects

of practice in reading are obviated. The data of Table XXXV, for example, represent the characteristic measures of eye movements made by Group A on first reading of each of the word-signs which appears within their three selections. In a similar manner the data expressing the number and kind of eye movements made in reading phrases and "other characters" have been tabulated. The numbers at the left of the word-signs in Table XXXV indicate the order of frequency with which the word equivalents appear in Ayres' List of the Thousand Commonest Words (1).

The Reading of Different Kinds of Characters

Word-signs.- Examination of Table XXXV shows that in general the word-signs which are simplest in structure presented the least difficulty in reading. The characters denoting the, and, a, and his required approximately one fixation each, whereas the word-signs ..., new, and ..... become, which are the most complex ones of the list, requires three fixations and 4.9 fixations respectively. Too, the simpler word-signs required fewer regressions than did the others. Reading the dot word-signs the, and, and a consists largely of interpreting the position of the symbol with respect to the line of writing. Virtually all of the mistakes made by the oral readers on the dot word-signs consisted of the mistaking of one of these characters for another. However, in the case of ....., become, which was misread orally as bring and book, the errors show that the silent readers, lacking mastery of this word-sign, attempted to interpret it by the direct reading of its parts. The relatively large numbers of fixations and regressions made in the silent reading of ..... and ....., new, indicate that the students could not readily recall the meaning of these word-signs in one or two perceptions and that they were obliged to study these characters in considerable detail.

TABLE XXXV

MEASURES OF THE EYE MOVEMENT MADE BY GROUP A IN READING THE WORD-SIGNS OF THEIR SELECTIONS

Word-Sign	Meaning	Average Number of Fixations	Average Number of Regressions	Average Duration of Fixations	Total Reading Time
1.	the	.8	.3	12.9	10.3
2.	and	1.3	.4	12.1	15.7
6.	a	1.0	.2	7.7	7.7
12.	was	2.6	.9	17.7	46.0
14.	will	2.7	.6	12.1	32.7
29.	his	1.3	.1	15.9	20.7
34.	become	4.9	1.6	11.2	54.9
56.	can	1.6	.6	16.3	26.1
60.	them	1.4	.4	15.3	21.4
74.	could	1.2	1.2	14.4	17.3
82.	should	2.0	.5	10.3	20.6
134.	new	3.0	.8	10.2	30.6
Median		1.5	.6	12.7	21.0

The numbers of fixations and regressions made on the other word-signs of Table XXXV indicate that the students in general were able to read them in approximately two fixations and that about one-third of these perceptions were regressive. Thus, in conclusion, it appears that beginning students in reading recognize immediately only a very few of the simplest and most commonly used word-signs. The others which are generally encountered in the first semester's work require varying degrees of circumspection or analysis.

Phrases.- The phrases listed in Table XXXVI illustrate three types of phrase construction. The first two characters ..... that the, and ..... could not, represent half-lengths. The last two phrases of the table are written in fourth position; by virtue of this position the word to or too is prefixed to the meaning of the characters. In the remaining characters of the table, normal outlines of simple words are joined directly to make two-word or three-word phrases.

If the data of Table XXXVI are examined in light of this threefold classification of phrase characters it may be seen that the numbers of fixations made by these students in reading the half-length phrases are considerably less than their median number of fixations for all of the phrases. In addition, the numbers of fixations required in reading the fourth position phrases are on the whole larger than the median number of fixations for all phrases. Likewise, in general the students made fewer regressions in reading half-length phrases, and more regressions in reading fourth position phrases, than they did on the whole body of phrases. From these observations it appears that the phrases which are commonly used with beginning students vary perceptibly in reading difficulty, and that half-length phrases are generally interpreted with the least, and fourth position phrases with the

TABLE XXXVI

MEASURES OF EYE MOVEMENTS MADE BY GROUP A IN READING THE PHRASES OF THEIR SELECTIONS

Phrases	Meaning	Average Number of Fixations	Average Duration of Regressions	Average Duration of Fixations	Total Reading Time
	that-the	1.8	.3	14.5	26.1
	could-not	1.9	.8	20.3	38.6
	to-his	1.3	.2	13.9	18.1
	they-may	3.0	.4	10.4	31.2
	they-may-be	2.2	.3	16.4	36.1
	should-be	3.7	.7	14.1	52.2
	if-they	2.2	1.5	9.9	21.8
	do-this	3.2	.7	18.6	59.5
	in-case	4.0	1.2	12.2	48.8
	in-this-case	3.1	.4	16.1	49.9
	to-show	2.6	.6	20.4	53.0
	to-invoice	5.7	1.5	15.1	86.1
Median		3.0	.7	15.0	43.5

greatest effort. It may be readily supposed that the simpler characters would require fewer fixations and regressions in reading than would the more complex ones. Accordingly, one might expect that more fixations and reading time would be required in interpreting the phrase they may be, than in reading the phrase to show. Reference to Table XXXVI shows that the beginning students used about 50 per cent more time in reading than in . The two characters required about the same number of fixations but twice as many regressions were made on the former phrase as on the latter. Thus a fourth position phrase consisting of merely a consonant stem may prove as difficult to read as a long phrase embodying three consonant stems.

In order that students may be able to recognize phrases readily, alone or in context, they should be given much practice in reading and writing these characters. Among shorthand teachers the importance of the student's mastery of phrase building in writing dictation is well recognized. In her transcription work the ability to read phrase characters readily is indispensable. The relative amounts of drill devoted to the reading and writing of different kinds of phrases should be proportional to the relative difficulty which the students generally encounter in mastering them.

Other characters.- As noted previously this caption is used to include all characters which are not word-signs or phrases. No attempt was made, however, to tabulate the eye movements which were made on all of the so-called "other characters" of the selections. Instead the writer selected, for the purpose of this comparison, those characters which appeared to be generally representative of all of the characters which were not word-signs or phrases. On the whole these "other characters" are a little more

complex in structure than are the phrase characters.

Table XXXVII presents data on the numbers and kinds of eye movements made by Group A in reading twelve characters which are not word-signs or phrases. The average numbers of fixations range from 3.2 in reading Sunday to ten fixations which were required in reading irksome. It may be noted from Table XLII and the two following ones that the beginning students made median numbers of 1.5 fixations in reading word-signs, 3.0 fixations in reading phrases, and 4.7 fixations on "other characters." Similarly, it may be seen that the median numbers of regressions made on the word-signs and on the phrases are roughly half of the median number of regressions made in reading the "other characters." These facts indicate that the reading of the less familiar and more complex characters proceeds in a more purely analytic manner than does the reading of word-signs and the more commonly used phrases. It is apparent that in interpreting a character composed of four symbols such as irksome that there are many more chances for error than in reading a phrase of two symbols such as they-may. Reference to the records of the oral readers shows that the first of these characters was interpreted by one student as orksome, by another as awesome, and that it was omitted by two others. The phrase was interpreted correctly by all of the oral readers excepting one who misread it as <u>that-may</u>. It is highly probable that several of the characters which were repeatedly fixated on by the silent readers were finally interpreted incorrectly.

The fact that a greater number of fixations and regressions were required in reading the "other characters" than in reading phrases may be attributed to three factors. First, the "other characters" were less familiar to the students and somewhat more complex than the phrase characters. Second, the phrase characters

TABLE XXXVII

MEASURES OF EYE MOVEMENTS MADE BY GROUP A IN READING "OTHER CHARACTERS" IN THEIR SELECTIONS

"Other Characters"	Meaning	Average Number of Fixations	Average Number of Regressions	Average Duration of Fixations	Total Reading Time
	advice	5.0	1.2	25.1	125.5
	induce	3.3	.5	16.1	53.1
	Sunday	3.2	.5	11.5	36.8
	exciting	6.2	1.7	12.8	79.4
	hostess	3.6	1.0	16.5	59.4
	abusive	3.6	.6	22.2	79.9
	business	6.8	2.2	12.0	81.6
	uncouth	4.4	.8	19.4	85.4
	irksome	10.0	5.0	12.7	127.0
	decency	3.5	.6	23.4	81.9
	customhouse	5.3	1.5	14.3	75.8
	offensive	5.5	1.5	10.8	59.4
Median		4.7	1.2	15.5	79.5

represent the combinations of short words such as auxiliary verbs, prepositions, conjunctions, and the more common adjectives and nouns. Hence, in many cases, the interpretation of a phrase outline may require direct perception of only the less familiar symbols of the character; the other symbols may be read peripherally. Third, the phrases generally serve as connectives between the word-signs and other characters; thus it is likely that, in part, the meaning of various phrases may be derived merely from the thought of the context.

Records of Two Groups of Beginning Students in Reading Different Kinds of Characters

Table XXXVIII presents a summary of the measures of eye movements made by the students of Groups A and B in reading word-signs, phrases and "other characters." It will be recalled that Group A employed the indirect method of learning and that Group B used the direct method. In Figures 9-12 inclusive the data representing four measures of the eye movements made by these groups are presented graphically.

The data of Table XXXVIII show that the records of the direct-method students surpass those of the indirect-method students in all measures of eye movements made in reading each of the three types of characters. In the reading of word-signs the median numbers of fixations made by the two groups approximate each other closely. However, the fixations of the direct-method students were not nearly as long as were those made by the indirect-method students. Also the direct-method students regressed only two-thirds as frequently in reading word-signs as did the indirect-method students.

In the number of fixations and regressions required in reading phrases and in reading the "other characters" the direct method students made appreciably better records than did the other

TABLE XXXVIII

MEDIAN MEASURES OF EYE MOVEMENTS MADE BY TWO GROUPS OF BEGINNING STUDENTS IN READING DIFFERENT TYPES OF CHARACTERS

Types of Characters	Median Number of Fixations		Median Number of Regressions		Median Duration of Fixations		Median of Total Reading Time	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Word-signs	1.5	1.4	.6	.4	12.7	9.7	21.0	13.5
Phrases	3.0	2.2	.7	.4	15.0	11.1	43.5	23.5
Other Characters	4.7	3.4	1.2	.9	15.5	10.7	79.5	40.6

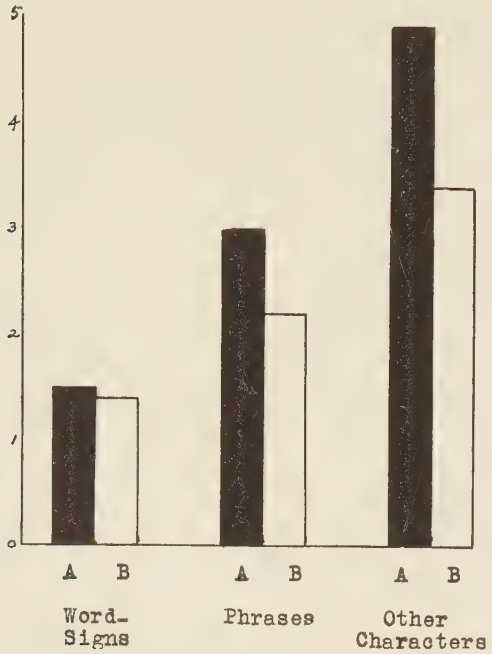


Figure 9. Median numbers of fixations made by Groups A and B in reading word-signs, phrases, and "other characters".

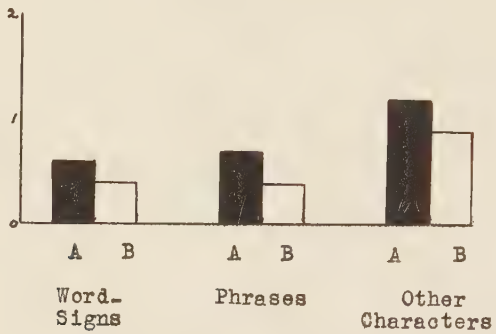


Figure 10. Median numbers of regressions made by Groups A and B in reading word-signs, phrases, and "other characters".

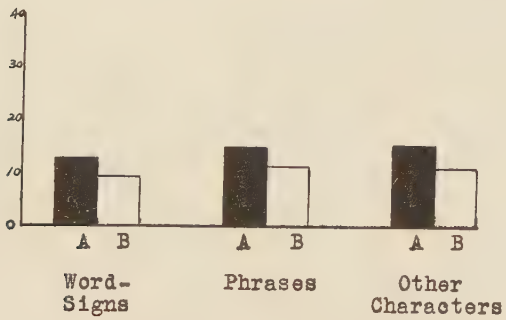


Figure 11. Median duration of fixations made by Group A and Group B in reading word-signs, phrases and "other characters".

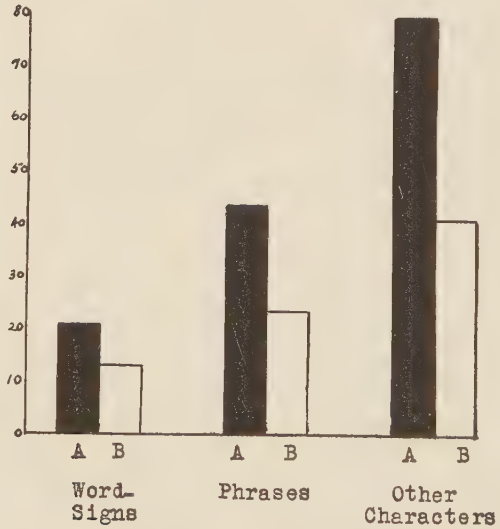


Figure 12. Median duration of total periods of time used by Groups A and B in reading word-signs, phrases , and "other characters".

group of beginners. The median of the total time spent by the students using the direct method in reading "other characters" is approximately half of that required by indirect-method students.

The validity of the comparison above stated is conditioned by the small numbers of students in the two groups and the possibility that reading difficulty of the characters used with one group may not have been equal to that of the characters used with the other group. The records made by the experts in reading the characters used with the two groups of students provide some evidence on the relative difficulty of the word-signs, phrases, and "other characters" in the selections used by the two groups of students. Table XXXIX presents the experts' records. Examination of these data indicates that there are no significant differences in the records of the measures of eye movements made in reading the word-signs, phrases, and other characters used by Groups A and B respectively. However, the number of experts used is small and the results of their reading do not necessarily show that the three types of characters in the material used by Group A are equal in difficulty to the corresponding types of characters in the material used by Group B. Nevertheless, it appears probable in light of the experts' records that one group of beginning students read word-signs, phrases and other characters which were not widely different in difficulty from the corresponding types of characters used by the other group.

If it may be assumed that materials used by the two groups of beginners were roughly equal in difficulty, the direct method students appear to have read the three types of characters somewhat more efficiently than did the indirect-method students. However, the data in hand are not sufficiently comprehensive to warrant a definite conclusion on this point.

TABLE XXXIX

MEDIAN MEASURES OF EYE MOVEMENTS MADE BY EXPERTS IN READING THREE TYPES OF CHARACTERS CONTAINED IN THE SHORTHAND MATERIAL USED WITH THE BEGINNING STUDENTS

Types of Characters	Median Number of Fixations on Material Used by		Median Number of Regressions on Material Used by		Median Duration of Fixations Made on Material Used by		Median of Total Time Spent in Reading Material Used by	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Word-signs	1.3	1.5	.4	.4	8.5	8.7	11.0	13.1
Phrases	2.5	2.4	.5	.5	9.2	10.7	21.0	23.5
Other Characters	4.5	3.7	1.3	1.3	10.5	10.2	43.5	35.2

Records of Advanced Students and Experts in Reading Different Kinds of Characters

Variations in the reading of three types of characters.- Table XL provides a comparative summary of the measures of eye movements made by the advanced students and the experts in reading word-signs, phrases, and "other characters" of the fourth group of selections. These data show that both the advanced readers and the experts experienced but slightly, if any, greater difficulty in reading phrases than in reading word-signs. This result is attributable, in part at least, to two causes. First, because of their length, complexity, and their unfamiliarity to the readers many of these word-signs were likely as difficult as many of the phrases. Second, in the work of the advanced students the development of skill in building phrases, and likewise in reading them in transcription, generally receives greater emphasis than does the mastery of word-signs.

In the reading of "other characters" the advanced students and experts made perceptibly larger numbers of fixations, and the students made more regressions than in the reading of word-signs and phrases. It may be noted, however, that the duration of the fixations made by both groups in reading "other characters" is not significantly different from the duration of their fixations made on the simpler types of characters.

The data in the last two columns of Table XL show that both the advanced students and the experts required nearly twice as much time in reading "other characters" as in reading either word-signs or phrases. It is very probable that, for these readers, the former characters were more difficult than the latter. The tendency of the advanced readers to make their shortest fixations on the most difficult characters contrasts sharply with the

TABLE XL

MEDIAN MEASURES OF EYE MOVEMENTS MADE BY ADVANCED STUDENTS (GROUP D) AND EXPERTS IN READING THREE DIFFERENT TYPES OF CHARACTERS

Types of Characters	Median Number of Fixations		Median Number of Regressions		Median Duration of Fixations		Median of Total Reading Time	
	Group D	Experts	Group D	Experts	Group D	Experts	Group D	Experts
Word-signs	2.5	1.7	.8	.4	8.7	8.9	20.6	14.6
Phrases	2.8	2.1	.8	.6	9.4	8.7	23.0	14.7
Other Characters	5.1	3.2	2.1	.8	8.4	8.5	42.7	26.7

tendency shown by the beginners learning by the indirect method who made their longest fixations on the most difficult characters. Reference to Table XXXVIII reveals that the fixations made by these beginners on the "other characters" were 15.5 units in duration. This period is nearly twice that of the advanced students whose median period of fixation on other characters was 8.4 units.

Comparison of records of advanced students and experts.- Further study of Table XL shows that there are no significant differences in the records made by the advanced students and experts in reading word-signs and phrases. There are appreciable differences, however, in the capacities of these groups to read "other characters." The experts read these characters with considerably smaller numbers of fixations and regressions, and required appreciably shorter time in reading than did the advanced students. The fixation pauses made by the two groups were approximately the same in length. The size of these groups is too small to warrant any conclusion on the relative degree of reading maturity which the advanced students had attained. However, in respect to their ability to interpret the other characters in their selections with fewer perceptions and in a shorter period of time, the stenographers were somewhat more proficient than the advanced students.

Summary of Chapter

1. The word-signs which are simplest in construction present the least difficulty in reading. The more complex word-signs require relatively large numbers of fixations and regressions. The students' lack of practice in reading word signs is apparently responsible for much of their difficulty in recognizing them in context.

2. Different kinds of phrases vary perceptibly in the degree of difficulty which they cause in reading. The half-length

phrases in the selections read by the beginning students were interpreted with appreciably less difficulty than were the fourth-position phrases. The complexity of the longer phrases increases their reading difficulty. A part of this difficulty may be due to the tendency to regard phrase characters as one-word outlines or the failure to recognize readily that the characters represent phrases.

3. The numbers of fixations and regressions made in reading the "other characters" show that they are much more difficult than word-signs and phrases. The "other characters" of the selections were more difficult than the phrases probably for these reasons:

a. They were generally more complex and less familiar to the students than were the phrases

b. The phrase characters were, in general, combinations of the outlines of the more common short words whose shorthand forms are easily recognized.

4. A comparison of the records of two groups of beginners in reading word-signs, phrases, and "other characters" indicates that the direct-method students read the three types of characters with somewhat less difficulty than did the other group of beginners The better records made by the direct-method students are mainly attributable to two factors:

a. The direct-method readers more generally attempt to perceive the characters as wholes than do the students learning by the indirect method.

b. The vowel markings in the material read by the indirect-method students increases the number of elements to be observed and probably increased the number of perceptions required in reading.

5. The records made by the advanced students in reading the three types of characters differ significantly from those made by the experts only in reading the "other characters." In reading these characters the advanced students were less proficient than the experts.

CHAPTER IX

SUMMARY OF RESULTS AND CONCLUSIONS

This investigation was made in order to determine how shorthand writing is read. The solution of this problem has been sought in two types of evidence. The first of these is represented by dictaphone records of the oral reading of three or four shorthand selections by thirty evening-school students. The second form of evidence consists of the photographic records of the eye movements made in the silent reading of the shorthand selections by forty-nine high school students and six competent stenographers. Both the students who read orally and those who read silently represent four levels of training in shorthand.

No effort has been made in the study to secure data which would distinguish the oral from the silent reading of shorthand. Students generally employ both forms of reading in learning this subject; and apparently a determination of the differences between the two forms would have little practical value. Oral reading has been used here for the purpose of securing evidence on certain important aspects of the reading process which are not revealed by the records of the silent reading.

The most significant findings from the investigation are reported in this chapter in two divisions: first, a general summary of the most important conclusions; and, second, a statement of other conclusions which are somewhat more specific in nature.

A. Summary of General Conclusions

1. Students make several important kinds of errors in reading shorthand. The kinds which have the most serious effect on reading are uncorrected misreadings of characters, reading delays requiring promptings, and omissions of characters. The least important kinds are the rereading and corrected misreading of characters.

2. The misreading of characters without correction is due primarily to the reader's failure to note close resemblances in the size, shape, and alignment of characters and to observe fine distinctions in the length, shading, and position of symbols.

3. Reading delays requiring prompting generally result from the reader's unfamiliarity with the character, its complexity of form, or misinterpretation of the previous context.

4. The omission of characters appears to be mainly attributable to inability to interpret the character, failure to see it, or to confusion experienced in reading the preceding context.

5. Characters are reread or reviewed apparently for the purposes of recalling or verifying the meaning previously given to them, or in order to recover meaning which had escaped the reader while she interpreted the following context.

6. The reader's tendency to correct her misreadings may arise from (a) her unwillingness to read loosely by leaving minor mistakes uncorrected, or (b) her inability to make further progress in reading until the mistaken character is correctly interpreted.

7. An analysis of the various kinds of errors made by thirty oral readers shows, indirectly, the most important requirements of this type of reading. These may be summarized as follows:

(a) The reader must frequently give attention almost simultaneously to three or more elements which characterize shorthand writing. Chief among these are the shape, length, shading, alignment and position of the symbols composing the characters.

(b) The reader must recognize the various symbols through careful perception of their physical properties. This often requires sharp discrimination between symbols which are very similar in form and appearance.

(c) She must be able to associate immediately the symbols with the meaning which they express.

(d) She mustbe able to discern readily the order in which the various symbols composing the characters are to be interpreted and in turn to assemble their meaning in the same order.

(e) She must occasionally verify the meaning given to symbols or to whole characters by rereading them or by referring to the context.

(f) She must retain the meaning conveyed by the preceding characters, and by combining this meaning with the preceding context, derive coherent thought from her reading.

8. Students show wide individual differences in both rate and accuracy of shorthand reading. Their variations in speed of shorthand reading are more pronounced than are their differences in speed of reading printed material.

9. In general no marked relation exists between the rates at which easy printed material and shorthand writing are read orally. These rates appear to be positively related in the reading of the advanced students and the beginners using unvocalized

material, but they are virtually unrelated in the reading of the other groups.

10. In reading shorthand a very short unit of subject matter is perceived in one fixation of the eyes. This unit frequently represents but a single symbol although occasionally it embraces two or more symbols. The perception span is necessarily short because of the complexity of shorthand writing.

11. Long periods of fixation also characterize this type of reading. The median duration of all fixations made by the students who read silently is 11.4 units. The great length of the pauses is evidence of the fact that fleeting glimpses of the symbols and characters are not, as a rule, sufficient for their recognition. Undoubtedly peripheral vision is employed to a considerable degree in the reading of isolated symbols and simpler characters. But in general shorthand characters are identified by the direct perception of their symbols and the reader must maintain the fixation pause sufficiently long to recognize the meaning of the symbol in its relation to other parts of the character or of the context.

12. The reading of shorthand requires extremely large numbers of fixations. The students who read silently made a median number of 31.9 fixations per line. The relatively short perception span which must be employed is primarily responsible for the large numbers of fixations. The analytic manner in which the characters are read, as indicated by the location of the fixations and the numbers of regressions, is a second factor which enlarges the number of perceptions.

13. This type of reading is further characterized by the number and nature of the regressive movements required. Approximately one-third of all of the fixations which the students made

in silent reading were regressive. The numbers of regressions and the order in which they were made indicate that the reading does not proceed in an orderly succession of forward fixations, but that progress is frequently interrupted by refixations on characters previously perceived and by a frequent shifting of attention back and forth between various parts of the line.

14. The reading of shorthand is yet further distinguished by its highly analytic nature. A considerable part of the material is read in a piecemeal manner. The reading of the more complex characters appears to consist generally of either (a) a broad overview of the character in two or three perceptions following which the reader's attention oscillates between this and the following character, or (b) a succession of fixations made more or less at random on various parts of the character. Apparently the perceptual analysis is accompanied by a crude synthesis of the meaning of the symbols and of broader parts of the character which results eventually in the recognition of its verbal meaning.

15. Students learning shorthand by the indirect method, who had had approximately three months of training in this subject, made significantly larger numbers of fixations and regressions in reading at the end than at the beginning of an additional six months period of study. Their fixation pauses, however, were but six-tenths as long at the end as at the beginning of the period.

16. The differences between the measures of eye movements made at the beginning and end of the same period by a similar group of beginners who were learning shorthand by the direct method are not sufficient to show any significant developments in the reading of the group. The photographic records of individual reading, however, provide evidence of the fact that various members of the group experienced different types of progress in

reading during the period. Some of the readers appear to have improved in reading skill although they made considerably larger numbers of fixations and regressions on the last than on the first reading. Their smaller numbers of eye movements made at the first reading seem to represent somewhat superficial reading. Other readers, as shown both by the measures of eye movements and by the nature of the photographic records, did consistently better reading at the end than at the beginning of the period.

17. The intermediate students, who had approximately eight months of shorthand study prior to the experimental period, read with slightly fewer fixations at the end than at the beginning of the period. While the differences between these numbers of eye movements are not statistically reliable, the general trend of the data is such as to indicate that the students as a group developed appreciably in power to read with fewer perceptions during the period. They also made substantially shorter perception pauses on the first than on the last reading.

18. The differences between the initial and final records made by the advanced students are such as to preclude any definite conclusion on the nature and extent of their progress as a group. It is possible that their performance at the final reading, which was near the end of the semester, was adversely affected by pending examinations and preparations for commencement. The advanced students like both groups of beginners showed a disposition to increase their numbers of perceptions at the last reading. The increase in the numbers of perceptions made by these groups at this reading may be due, in a large measure, to a greater tension and desire to do well which the students might have experienced at the last reading. Aside from this, the increase may represent a modification of their habits of perception, discrimination, and recognition toward greater efficiency in reading.

19. The beginners learning by the indirect method and the intermediate and advanced students were relatively less proficient in reading than were the stenographers serving as expert subjects. Because of unavoidable limitations in the study the data do not warrant a determination of the comparative attainments of the student groups. The records of the direct-method students apparently approximate the records of the stenographers more closely than do the records of any other group. However, the character of the reading material read by this group was such that it may have been appreciably more difficult for the stenographers than were the other selections.

20. The most significant point of difference between the measures of the eye movements made by students and by the stenographers is the duration of the fixation pauses. The beginners learning by the direct method and the intermediate students clearly had not arrived at the level of maturity represented by the relatively short perceptions of the experts. In pause duration the records of the direct method students and the advanced students are not significantly different from those of the experts.

21. The word-signs, in general, presented less difficulty in silent reading than did phrases and "other characters." The more complex word-signs required relatively large numbers of fixations and regressions. Apparently the students had not had sufficient practice in reading and writing these characters in context to enable them to read the longer word-signs effectively.

22. The beginning students experienced appreciably more difficulty in reading phrases than in reading word-signs. Half-length phrases were interpreted by these students with much less effort than were fourth-position phrases. The advanced students and stenographers read phrases virtually as easily as they did word-signs. A factor which probably influenced this result is

the fact that in the class work of advanced students greater emphasis is frequently given to writing and reading phrases than to word-signs, since a high level of skill in phrasing is of great value to the stenographer.

23. The "other characters" caused the greatest difficulty in reading. The complexity of these characters and the fact that they appeared less frequently in the reading and writing exercises of the students than did phrases and word-signs account chiefly for the larger numbers of fixations and regressions made in reading them.

B. Specific Conclusions

How students misread.-

1. When students misread shorthand characters they make a variety of specific errors which are revealed when their misreadings are carefully examined. The most important of these errors are:

(a) Confusion of symbols and of characters

(b) Misreading position

(c) Misreading shading

(d) Omission of parts of characters

(e) Addition of parts to characters

(f) Misreading length

(g) Neglect of the context

2. Students show a marked tendency to confuse full-length stems which are not word-signs. Curved stems are confused with each other more frequently than are straight stems. The greatest difficulty appears in upward and downward l. The confusion of closely related hooks is also relatively common in reading. The l-hook, r-hook, f-hook and n-hook were readily mistaken for each other and for stems and breves.

3. Confusing the fundamental parts of characters is due primarily to faulty perception. The inability to recognize or associate the correct meaning with the symbol after it has been carefully perceived is another important cause of confusion in reading.

4. Misreading the position of symbols and characters occurs most frequently in the reading of word-signs. Misinterpretation of the shading of these characters or of their parts and the confusion of similar elements is the next most common form of misreading. These two types of errors are made more often in reading the simpler word-signs than in the more complex ones.

5. The failure to discriminate between the position of symbols appears to be due chiefly to inaccuracies in space perception or to the careless observation of the position of the symbol in respect to the line of writing. The errors in misreading shading may be attributed to (a) careless perception of the outlines or (b) the confusion of the two phonetic sounds represented by the light and heavy shading of a given stem.

6. A common form of omission is the failure to interpret the s-circle. The students omitted this symbol more frequently than they confused it with the large circle or with other symbols. It is probable that most of these omissions were due to the fact that the reader's misinterpretation of the character containing this symbol precluded the use of the s-sound in its proper connection.

7. Oral readers make fewer errors by adding meanings which are not expressed by the characters than by failing to interpret all parts of the character. Varied meanings, however, are added. This error results mainly from the necessity of inserting or appending sounds or syllables not expressed by the character in

order to conclude its interpretation, when one or more parts of the character have been misread or omitted.

8. The length of consonant stems is misread more frequently than is that of any other character element. Lack of care in perceiving outlines and interchanging the meanings of half-length, full-length, and double-length stems, when the outline has been accurately recognized are the most likely causes of this error.

9. The reader's failure to make proper use of the context, when reference to it would have aided in interpretation, is responsible for a very small part of the uncorrected misreading. Various conditions may have influenced the reader to neglect the context. The most important of these probably are the habit of reading from the direct interpretation of the characters and the reader's unawareness of certain errors which she made.

Analytic nature of shorthand reading.-

1. The complex nature of shorthand writing necessitates large numbers of fixations and regressions in reading. Such reading generally proceeds in an irregular series of backward and forward movements of the eyes and is marked by minute analyses of many of the characters. Frequently the analyses extend over two or three adjoining characters and in some instances nearly whole lines are perceived and reperceived in great detail.

2. Three types of regressive fixations may be recognized in the records:

(a) Regressions made near the beginning of the line. These were made on the first one or two characters in the line. They were caused apparently by an overleaping of these characters as the eye or center of attention shifted rapidly from the end of a line to the beginning of the next one.

(b) Regressions to adjoining characters and between more widely separated parts of the line. These regressions were very commonly made. In many instances the widely separated regressions seem to have been made largely at random.

(c) Regressions made within the character. These occur most frequently in the detailed examination of the character. They appear to have been made in effort to identify the symbols accurately or to discover between them relations which had not been previously observed.

3. The fixation pauses were frequently maintained for very long periods. As a rule the longer pauses were made in reading the more complex characters. In many instances the longest pauses were made in highly analytic reading; however, very long fixations were sometimes made in unanalytic reading.

4. The eye-movement records provide abundant evidence of serious difficulty in reading. They show that prolonged and repeated attempts were made in reading a considerable part of the material. The readers completely dissected many characters in bewildered efforts to interpret them. In such cases they literally deciphered, rather than read, the shorthand writing.

Important differences between reading shorthand and printed material.-

1. As concluded previously (p. 181), the perception span in shorthand reading is very short, embracing generally a single symbol or a simple character; it occasionally encompasses three or four symbols. In reading print the span of perception generally includes as many as two words of average length and frequently it covers combinations of three or more words.[1]

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[1]In this comparison it is assumed that the general characteristics of the process which is ordinarily employed in reading printed material are sufficiently well-known that they require no explanation here.

2. In shorthand reading the perceptual process assumes an entirely different pattern from that required by print reading. The elements in printed expression such as letters, syllables, and words are far less diversified in shape, size, alignment, shading, and position than are the corresponding elements in shorthand, namely, the symbols and characters. In fact, printed expression introduces very few variations in meaning through differences in the alignment (slant), shading, or the vertical position of its elements. In shorthand not only do variations in the size and shape of the symbols represent differences in meaning, but through changes in alignment, shading, and position the capacity of the symbols to express varied meanings is vastly increased. The unique property of the symbol by which it undergoes modifications of form to express differences in meaning, focuses the reader's perception upon its physical features. Hence perception in shorthand reading assumes a very complicated pattern which is necessitated by the great diversity in the physical form of the symbols and their consequent variety of meanings. The complexity of the pattern is increased further by the number and peculiarities of the combinations in which the symbols may appear.

3. Recognition, too, proceeds differently in shorthand reading than in reading print. Generally the symbols are recognized individually or in short combinations and their meanings are fused into wholes representing words or phrases. The unit parts of the character must be recognized and their meanings combined in the order in which they are written which is not necessarily progressive. The corresponding elements in printed expression, syllables and words, are commonly recognized in a straightforward manner. Thus, recognition in shorthand reading is a much more detailed procedure, and is accompanied by a much greater degree of trial and

error in combining the elements of meaning than is recognition in print reading.

4. A fourth difference in the two types of reading is the absence, in shorthand reading, of the rhythm and fluence which ordinarily characterize print reading. The records of the eye movements of the silent readers show that on the whole their fixations were made in a very irregular order. Occasionally, in reading the simpler parts of the material the perceptions were made fairly evenly along the line and with a minimum number of regressions. However, the records show that for a majority of the readers the numbers of pauses and periods of time required in reading successive lines of their material differ widely. In addition, the dictaphone reproductions of the oral reading of shorthand showed conclusively that such reading is marked by great irregularity of progress along the line and a most noticeable lack of rhythm in interpretation.

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